Volume 61

American Machinist

Number 6

New York, August 7, 1924

Electrical Equipment for Machine Tools

By John W. Harper

Industrial Engineering Dept., General Electric Co.

General features—Characteristics of various types of motor controllers—Duty each type is best fitted to perform—Under-voltage protection—Magnetic or push-button control

MOTOR control for machine tools may be divided into three general classes—dial, drum and magnetic. No fixed line can be drawn limiting the use of each, as it would be impossible to say that one type only should be used on any certain machine tool. The conditions of operation, size of machine, etc., would have great bearing on the type of control to be used.

The dial-type controller has the most limited field, although there are applications where this type fits in to very good advantage. It is used chiefly on small sizes of motors and where the motors are started infrequently. Blowers and small grinders are good examples of such applications. Such control does not, as a rule, provide overload protection, but it does give under-voltage protection. Dial-type controllers are generally non-reversing. For machine tools the forms provided with enclosing covers, having the operating handle on the outside, are to be recommended. No live parts with which the operator might come in contact are exposed. The resistor units are mounted in a perforated cover behind the base carrying the contacts.

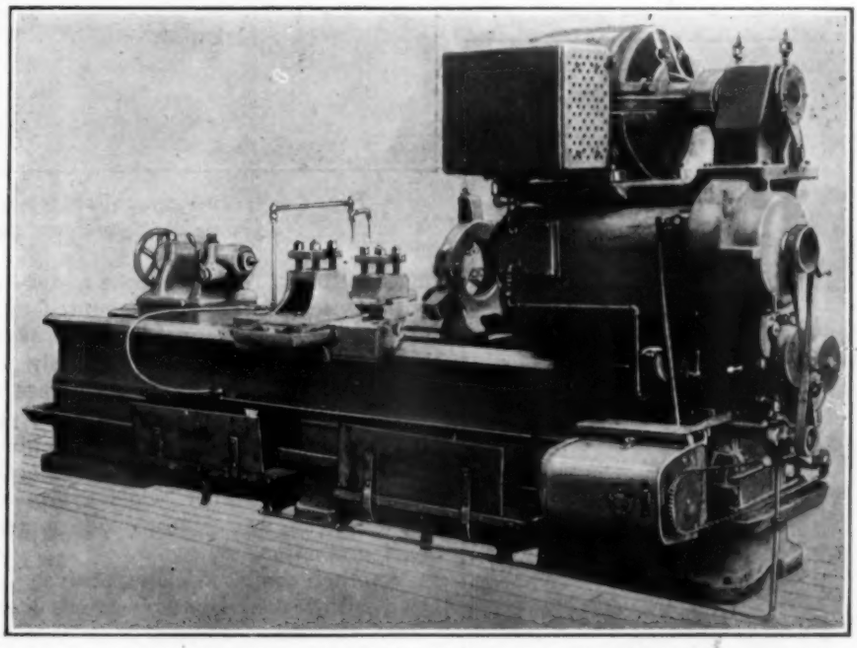


Fig. 1—Adjustable-speed direct-current motor with drum-type controller and resistors, mounted on lathe.

Drum-type controllers can be used for motors driving practically any type of machine tool. The switches are strong, totally enclosed and can be used for frequent starting. Controllers of this type are made both reversing or non-reversing. Controllers for use with constant-speed motors may be used for either starting or regulating service, a different resistor being required in each case. Drum switches for adjustable-speed motors (direct-current) usually provide only a small number of armature points, the rest of the switch range being used for the field points. The field is controlled by fingers in the same manner as the armature. In all sizes, the field resistor is mounted on the back of the drum switch. The starting resistor for the smaller sizes is mounted in the same way, but for the larger sizes it is separately mounted in a perforated-metal box. This method of mounting prevents chips or other material falling on the grids. Overload and undervoltage protection may be obtained by means of an auxiliary protective panel. Drum switches provide dynamic braking at the off position, by means of a separate resistor, if required.

First part of the article. Conclusion will be published in an early issue.

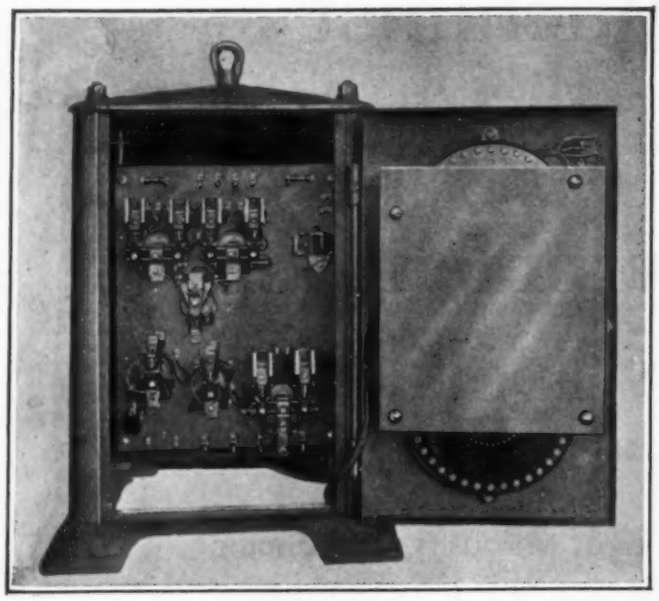


Fig. 2—Reversing controller for planer. Pedestal-type panel—25 to 35 hp., 230 volts

In Fig. 1 is shown an adjustable-speed motor with drum-type controller and resistors, mounted on a lathe. The switches require little space and can be mounted where most convenient for the operator. The armature resistors can be placed at some out-of-the-way point. The switches may be operated directly or through chain and sprockets from a splined shaft. This allows them to be placed on some part of the machine, as, for instance, the head end of a lathe, and to be operated from the apron. In this manner the operator always has the control of his motor near at hand.

Magnetic control finds extensive use where it is desirable to control the operation from a remote point, or from several points. It is also advantageous where drum control becomes too large and cumbersome, or where there is a special duty cycle, as for instance on a reversing planer. This form of control, shown in Fig. 2, usually incorporates all the safety features such as overload and undervoltage protection. Magnetic control, with a proper selection of limit switches to stop, start, or slow down the motor at predetermined points, and push-button stations, forms a most flexible and convenient method of controlling the functions of any machine tool. Fig. 3 shows a motor-driven floor grinder with switch of this type mounted in the base.

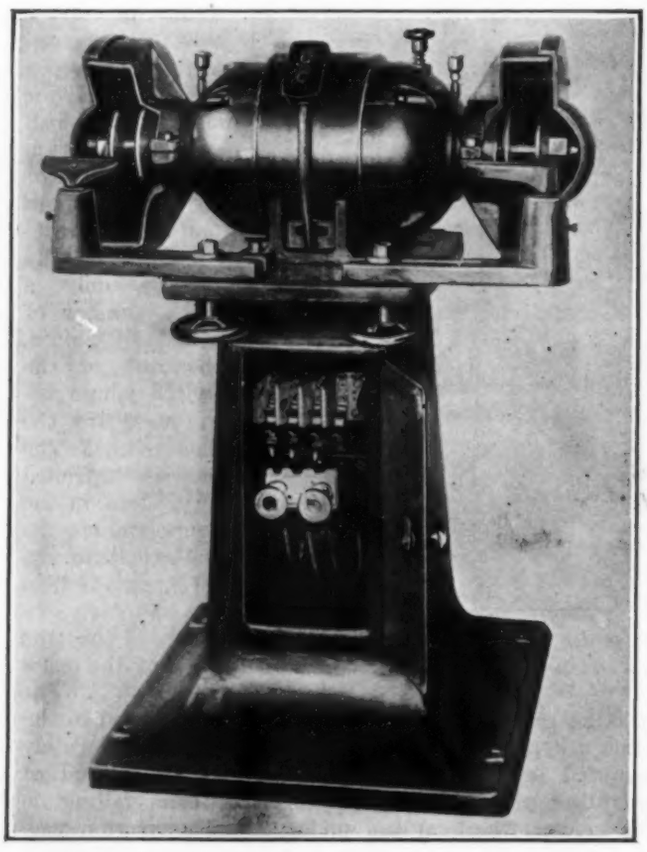


Fig. 3—Starting switch mounted in base of floor grinder

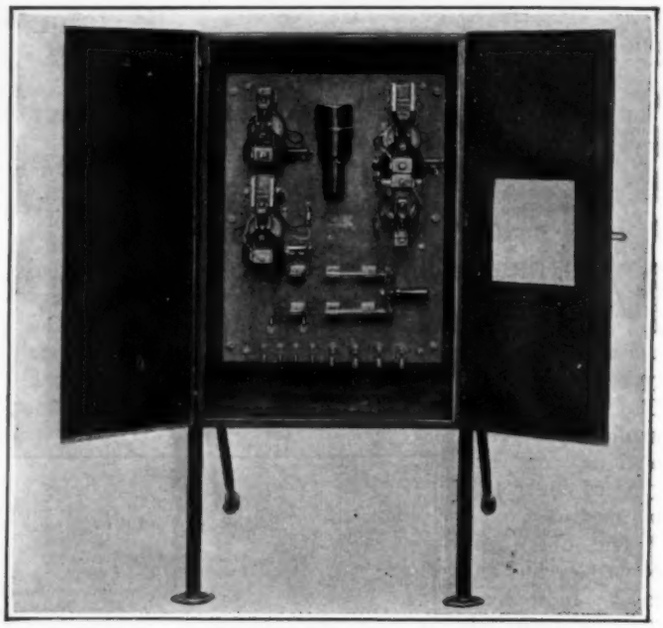


Fig. 4—Special controller for wheel lathe—providing slow-down point

Alternating-current magnetic switches with push-button control are advantageously used in connection with small machines. The switches themselves can be mounted near the motor with the push-button station on the machine where most convenient to the operator.

Combinations of hand and magnetic control are possible, as for instance, when a protective panel is used with a drum switch to provide undervoltage and overload protection.

Another combination extensively used is in connection with large adjustable-speed, direct-current motors. Here, instead of using a drum switch for armature and field points, a master switch and a magnetic-starting panel are provided. The master switch contains field points as explained above, but instead of handling the armature circuit, it has segments for the control circuit of the magnetic panel only. The master switch is operated in the same manner as the drum switches, i.e., directly, or through a splined shaft with chain and sprockets, or gears, etc. The first point energizes the line contactor and the motor is automatically accelerated to the speed corresponding to the position of the switch with reference to the field points. Under-

voltage protection is provided by a relay in the bottom of the master switch. The switch handle being in the off position the armature of the relay is pushed against the core. The armature carries a circuit which is closed when the relay closes. This circuit makes the holding circuit for the relay coil, and also the pick-up circuit for the line contactor on the magnetic panel. If voltage fails, a spring throws back the armature and opens the circuit.

Specialized forms of control having features particularly adapted to certain tools have also been developed. An example of this is the reversing, planer-type control, so arranged that the speed of the motor is higher in the reverse than the cut direction. It is also provided with dynamic braking to cut down the time of changing from forward to reverse to the minimum value consistent with good operation. An emergency-braking section is also provided so that in an emergency the motor will be stopped in less time than given by the normal brake. Another form of this specialized control, as shown in Fig. 4, is for wheel lathes. In turning the treads of wheels after they have been in service, hard

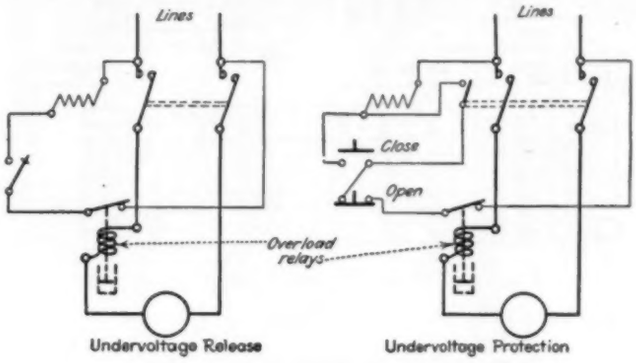


Fig. 5—Diagrams of undervoltage release and protection

spots are often encountered. The control is such that the operator, when he approaches such a place, can press a button that will give him a slow speed on his motor as long as the button is depressed. After the hard spot has been passed and the pressure on the button released, the motor will come up to its original speed.

In the selection of control for machine tools, one of the chief considerations is safety—safety and protection to the operator, the machine, the motor, and the product. Convenience and simplicity of operation are also of great importance. In order to secure a safe equipment, enclosing cases or covers are recommended wherever possible. This not only provides safety from accidental contact with live parts, but, since the cases can be locked shut, all but authorized persons are prevented from opening them and making adjustments. As a convenience in operation, line switches, when furnished with enclosed equipments, are usually arranged so that they can be operated from outside the case.

Other features of modern control for obtaining safe and convenient operation are described more in detail in the following:

Undervoltage release is inherent in any kind of motor control device. That is, if voltage fails the motor will stop and, unless someone opens the line switch, it will start up again when voltage returns. Such a control should not be recommended, especially for machine tool use. Suppose, for instance, that a boring-mill motor were controlled in such a manner. Voltage fails and the motor stops. The operator forgets to open the line switch. He notices some adjustment to be made, and unthinkingly, steps up on the machine. He may even get some clamps loosened, when voltage returns and the motor starts unexpectedly, with disastrous results.

On the other hand, the function of undervoltage protection can be easily provided and is to be recommended in machine-tool operation. This requires a push-button station or some other form of momentary-contact master switch when used with magnetic control. Undervoltage protection is defined as "The effect of a device operative on the reduction or failure of voltage to cause and maintain the interruption of power to the main circuit." (*Electric Power Club.*) In other words, should voltage fail, the main circuit is automatically opened and cannot be closed until the push button or other master switch is operated. This prevents anything but a deliberate action on the part of the operator from starting the motor. It cannot start of itself when voltage comes back on the line, and hence protects the operator and the machine against an unexpected start.

Equipment for Undervoltage Protection

In dial type starters this protection is obtained by having the starting arm move against a spring. A shunt coil, energized from the main power supply, holds the arm in the running position as long as there is voltage on the lines. Upon failure of voltage, the spring returns the arm to the starting position, from which it must be moved by hand to restart the motor. Fig. 5 gives diagrams showing the difference between undervoltage release and protection.

When drum-type control is used, an auxiliary protective-panel is recommended which provides this protection through an off-position circuit on the drum switch. The wiring is such that the switch must always be in the off position before the line contactor can be closed, by an off-position contact in the drum switch or other means.

With magnetic control, a momentary-contact type of control station, usually a push button, is furnished. This contains a normally-open and a normally-closed circuit. Closing the open circuit energizes the line-contactor coil and the contactor closes. An auxiliary interlock on this contactor bridges the "start" circuit of the push button, which can then be released. The coil circuit then goes through the interlock and the normally-closed contacts of the push-button station. Hence, if voltage fails, the interlock circuit opens, thus requiring that the button be pressed to start the motor again. The motor may be stopped at any time by opening the normally closed or "stop" circuit.

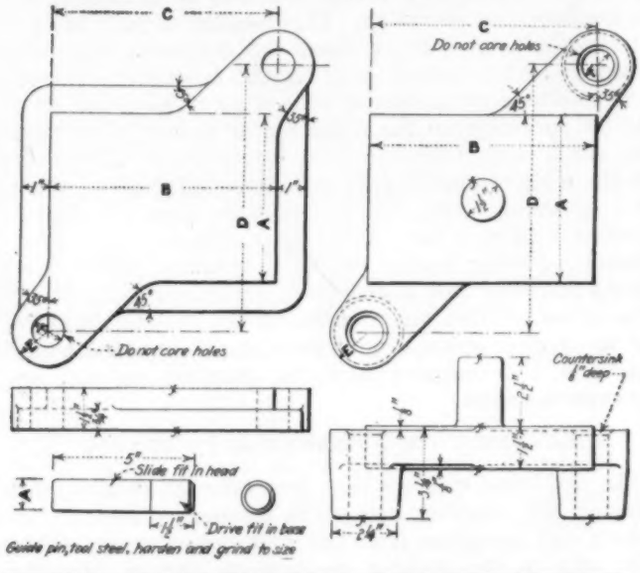
Erratum

The Manhattan swing-frame grinding machine and detachable grinding wheel spindle, published on page 904, Vol. 60, of the *American Machinist*, and indexed as item No. 50 on page 99, Vol. 61, in the review of new equipment, was wrongly credited to the Riverside Production Co. of Newark. It is manufactured by Sheely & Lange and is being marketed by the Manhattan Rubber Manufacturing Co. of Passaic, New Jersey.

Standard Pillar Press Heads and Bases

By Herbert C. Crawford

Pillar presses are being used extensively by nearly all large makers of machines having a great number of stamped parts. For typewriters and adding

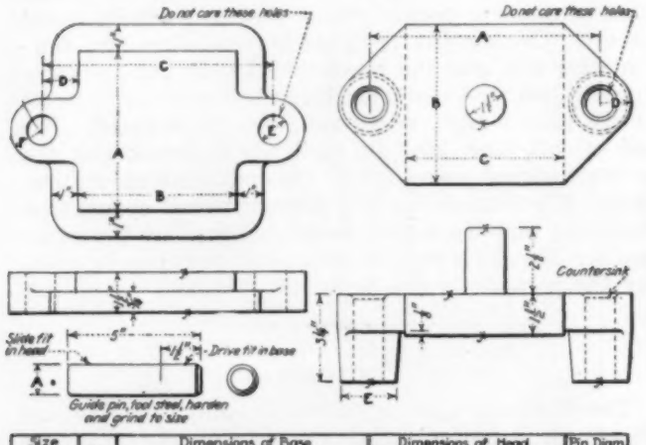


Size AxB	No.	Dimensions of Base A	B	C	D	E	F	Dimensions of Head A	B	C	D	E	F	Pin Diam. A
4"x6"	32	4	6	6	7⅛	¼ R.	1" Ream	4	6	6	7⅛	¼ R.	1" Ream	1"
4"x8"	33	4	8	8	7⅛	¼ R.	1" Ream	4	8	8	7⅛	¼ R.	1" Ream	1"
4"x10"	34	4	10	10	7⅛	¼ R.	1" Ream	4	10	10	7⅛	¼ R.	1" Ream	1"
6"x6	25	6	8	8	9⅜	½ R.	1¼ Ream	6	8	8	9⅜	¼ R.	1¼ Ream	1¼"
6"x10	35	6	10	10	9⅜	½ R.	1¼ Ream	6	10	10	9⅜	¼ R.	1¼ Ream	1¼"

Fig. 1—Small pillar press with diagonal pillars

machines pillar presses are used almost exclusively for many punchings and unless the tool designer has the idea of standardization pretty firmly fixed in his head, it is very easy to collect a lot of various sizes in a very short time.

The Corona Typewriter Co., Groton, N. Y., uses



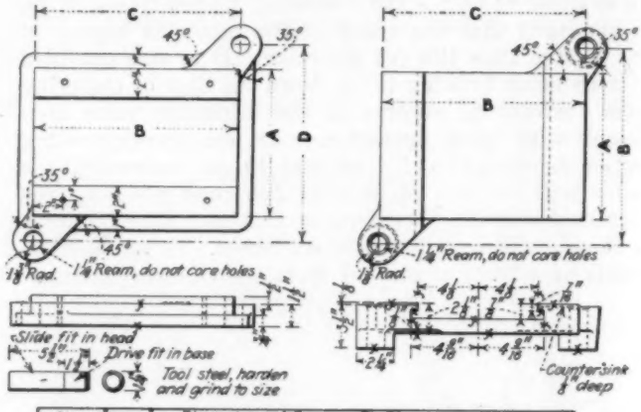
Size AxB	No.	Dimensions of Base A	B	C	D	E	F	Dimensions of Head A	B	C	D	E	Pin Diam. A
4"x4"	28	4"	4"	7"	1⅞"	1" Ream	⅛" R.	7"	4"	4"	1⅞" R.	2"	1"
6"x6"	29	6"	6"	9"	1⅞"	1" Ream	⅛" R	9"	6"	6"	1⅞" R	2½"	1¼"
6"x8"	30	6"	8"	11"	1¼"	1¼ Ream	¼" R	11"	8"	8"	1⅞" R	2½"	1¼"

Fig. 2—Pillars in center at ends

pillar presses in great numbers. Naturally the necessary sizes vary to a considerable extent but the sizes shown herewith have been standardized. All necessary dimensions are given so that but little explanation is necessary.

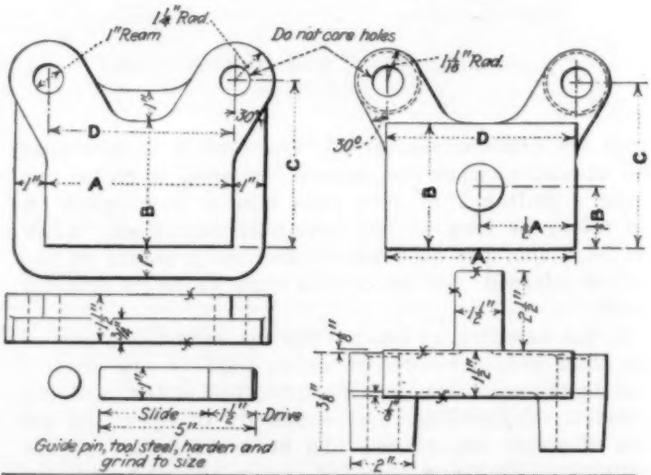
The dimensions of the base and head are given for each size. Fig. 1 shows a pillar press with the pillars or guide pins at the diagonal corners, while in the one shown in Fig. 2 the pillars are central at each end. The presses of both types are approximately the same size, and are the smallest ones used.

A larger pillar press, also of the diagonal-post type,



Size AxB	No.	Dimensions of Base A	B	C	D	Dimensions of Head A	B	C	D
8"x10"	36	8	10	11⅛	11½	8	10	11⅛	11½
8"x12"	37	8	12	12	11½	8	12	12	11½
8"x14"	38	8	14	14	11½	8	14	14	11½
8"x16"	39	8	16	16	11½	8	16	16	11½
8"x18"	26	8	18	18	11½	8	18	18	11½
10"x14"	48	10	14	14	13½	10	14	14	13½

Fig. 3—Larger diagonal pillar press

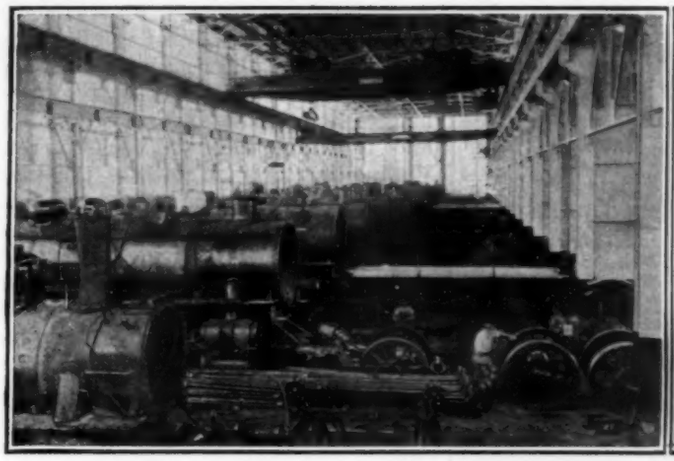


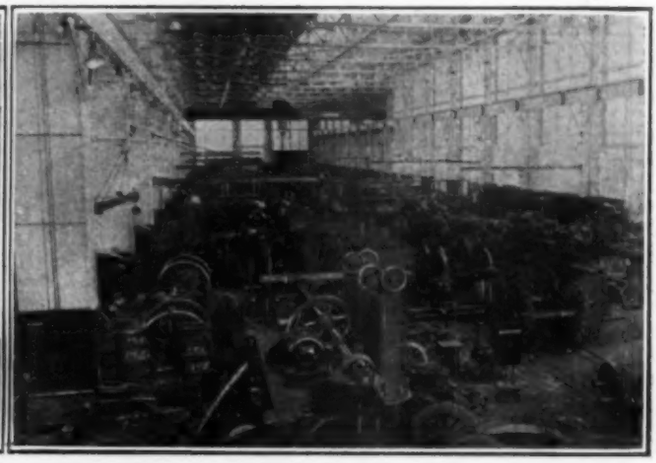
Size	No.	Dim. of Base A	B	C	D	Dim. of Head A	½A	B	½B	C	D
4x6	40	6	4	5⅞	6	6	3	4	2	5⅞	6
4x8	41	8	4	5⅞	8	8	4	4	2	5⅞	8
4x10	42	10	4	5⅞	10	10	5	4	2	5⅞	10
5x5	43	5	5	6⅛	5	5	2½	5	2½	6⅛	5
4x4	44	4	4	5⅞	5	4	2	4	2	5⅞	5

Fig. 4—Open front pillar press

is shown in Fig. 3. The press illustrated in Fig. 4 may be called the open type, as both pillars are at the back. It is also of a small size, otherwise the pillars would be considerably larger in diameter.

The types and sizes given seem to cover about everything necessary in the way of pillar presses for the great majority of shops. The Corona Co. has found a great saving by adhering to the standard designs as shown.





Locomotive Repairs at the Bellmead Shops

By Howard Campbell
Western Editor, *American Machinist*

M. K. & T. shops at Waco equipped with new machinery throughout—Reducing costs by use of latest types of tools and attachments — Design and use of special equipment

AMONG THE improvements made last year by the Missouri, Kansas and Texas Railway was the construction of complete new shops at the Bellmead terminal, Waco, Texas. The unique idea was followed out of housing practically all of the more important departments in one building, including the machine, erecting, blacksmith, boiler and stores departments. The shop is of the transverse type with 15 pits, built to handle from 16 to 20 locomotives per month, but the construction of the building is such that it can be readily expanded to take care of 40 engines per month. The locomotives are lifted in the erecting bay by a 180-ton crane of 75-ft. span, with a 15-ton crane below the large one to handle the lighter parts. A 15-ton crane serves the machine department. All machine tools are driven by individual motors, to which power is carried through conduits under the floor.

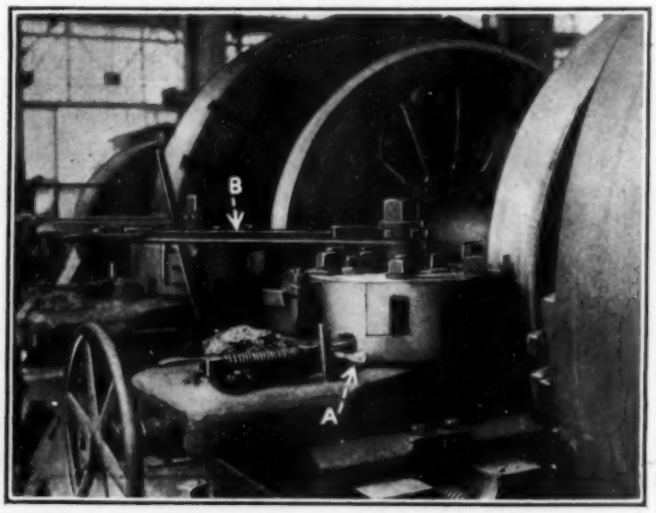


Fig. 1—Tool-turrets on Sellers wheel lathe

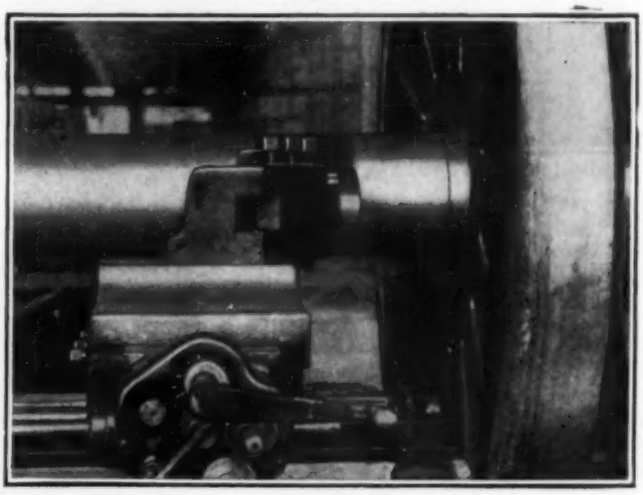


Fig. 2—Rolling driving-wheel journals

An engineer has been assigned to look after the efficiency of tools and methods, and special tools and fixtures are employed wherever they can be used to

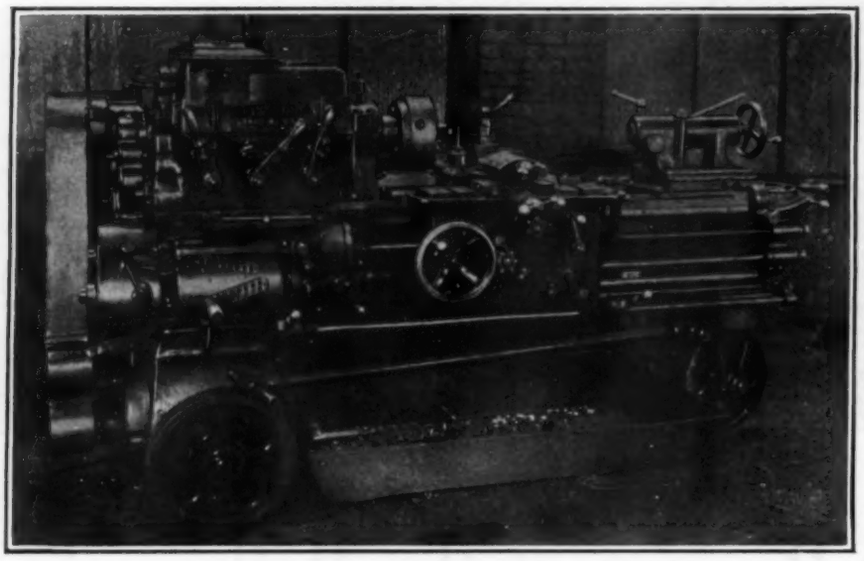


Fig. 3—Portable lathe in erecting shop

advantage. The shop is equipped with new machinery of the latest design and with the latest in attachments, as exemplified by the tool-turrets on the machine illustrated in Fig. 1. The operation is that of turning a pair of driving wheels, using a Sellers wheel lathe for the job. There are two turrets, each carrying a 1¼x3-in. forged tool for rough turning, a box tool and roughing, forming and finish-forming tools for the flange—a complete set of roughing and finishing tools in each turret. Pulling the lever *A* releases the turret so that it can be swung around, which is done with the aid of the ratchet handle *B*. The efficiency of such a tool turret is evidenced by the fact that a set of bad wheels can be turned complete in 1 hr. 15 min., while a fairly good set can be finished in 45 minutes.

The journals on the driving wheels are rolled after turning, using the rolling tool shown in Fig. 2. The interesting feature of the tool is the shape of the block to which the roller is attached, the roller being held at one side so that the journal can be rolled close to the wheel. A similar roller of reverse construction is used on the other journal. Black oil is used to lubricate the roller. The work revolves at a speed of 15 r.p.m., and the feed is $\frac{1}{32}$ inch.

Eighteen Lehmann lathes are included in the shop equipment, one of which is the portable lathe shown in Fig. 3. This machine is used to make bolts for the erecting department and is moved about the floor as required. Another Lehmann lathe is shown in Fig. 4 turning a crank pin. The pin shown in the lathe is of the largest size in use, having a wheel fit of 9½ in., main rod fit of 8½ in., 9¼ in. side rod fit and a length of 25⅝ in. There is usually enough stock on one of these pins to take a cut ½ in. to ¾ in. deep, although the cut shown in the illustration is light. A main rod pin is turned out in from 1½ to 1¾ hours.

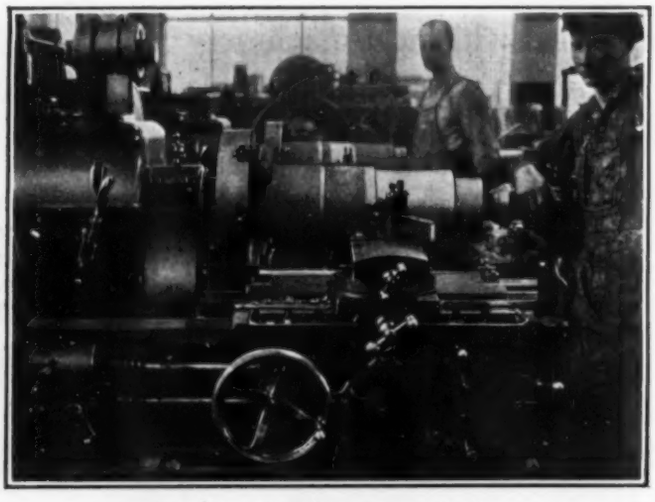


Fig. 4—Turning a crank pin

Use for Old Axles

Smaller crank pins are made out of old axles, an axle serving to make eight pins. The diameters for the eight pins are rough-turned in the lathe, then the axle is put into the Newton cold-saw shown in Fig. 5 and the pins are cut off. They are then centered in the centering machine and finish-turned in the lathe. An axle can be sawed up in approximately eight hours, and a machine which would otherwise be standing idle most of the time is kept busy on productive work.

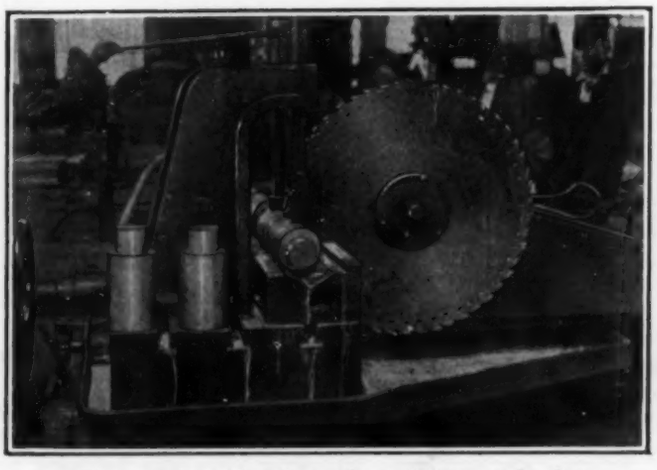


Fig. 5—An old axle makes eight crank pins

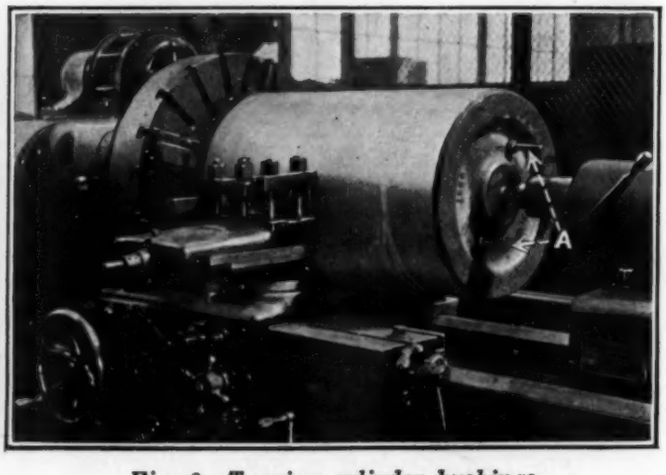


Fig. 6—Turning cylinder bushings

Old crank pins are annealed and knuckle pins are made out of them in the same manner.

Cylinder bushings are turned in the 42-in. Putman lathe shown in Fig. 6. The bushing is located on centers in a pair of heads that are held in the ends of the bushing by the bolts *A*, the chuck jaws serving to drive the piece. The bushing is turned to two diameters so that it can be inserted half way before pressure need be applied.

Tire Boring Practice

The illustration Fig. 7 shows the operation of boring tires on a Betts boring mill. The tools are of 1x1¾-in. high-speed steel. A roughing cut of approximately ⅛ in. and a finishing cut of 1/16 in. is taken with a 1/16-in. feed, the tire revolving at a speed of 1 revolution in 43 seconds. A tire can be finished in 45 minutes on this machine.

All rod bushings, both floating and solid, are made in the boring mill shown in Fig. 8. This mill, together with the press that is used to press the bushings into place, is set as close to the rod department as possible. The operator also makes all bushings and side rod collars and roughs out the bull rings. The usual time for finishing a main rod bushing is 28 minutes. All other Bullard boring mills are grouped as shown in Fig. 9.

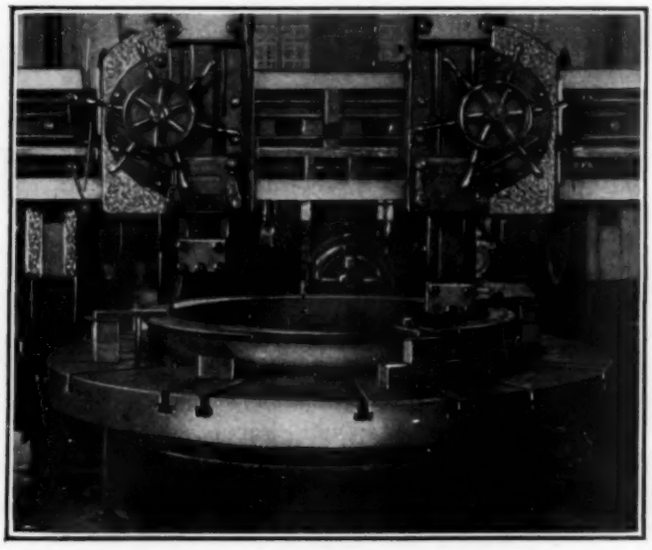


Fig. 7—Boring a tire

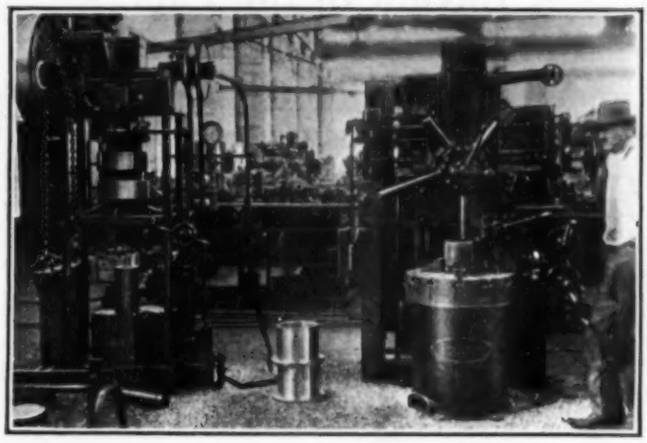


Fig. 8—All rod bushings are made and pressed in here

Among the other jobs that come to the Bullard boring mills is that of boring, counter boring, turning and facing the hub-plates for the main drive wheels, as shown in the illustration Fig. 10. The finished diameter of the shoulder is 19 in., and with two tools working simultaneously, the piece is rough and finish turned, faced and bored in something like thirty minutes.

Fig. 9—A group of boring mills

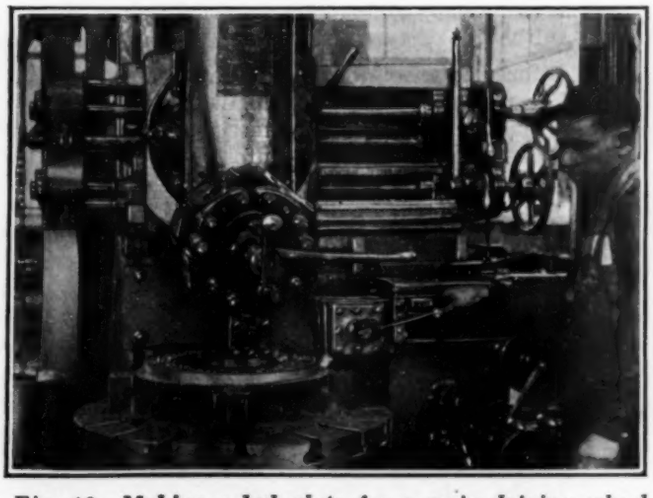


Fig. 10—Making a hub-plate for a main driving wheel

(To be concluded)

Some New Alloy Steels

We have become fairly familiar with the S.A.E. steels and most of us have a fair idea as to what is meant when we read of 1020 steel. There are, however, newcomers in the field which are not clear to all of us, such as the U.M.A. No. 4 or No. 6. The U.M.A., or Uma steels as some call them, have been developed by the Central Steel Co. for special service and the numbers given are as follows: No. 4—carbon 0.35, manganese 0.85, chromium 1.10. No. 6—carbon 0.55, manganese 0.85 and chromium 1.10, the carbon content evidently varying about 10 points per number.

A Review of the Papers Presented Before the First World Power Conference

By Lillian M. Gilbreth

THE over four hundred papers presented at the First World Power Conference in London June 30th-July 12th furnish a wonderful body of information. The reader who is not a specialist in the field of power is impressed first by the broadmindedness and farsightedness of the writers, in thinking out and working through papers that have a general as well as a special and technical significance. An enormous amount of time and effort must have been spent by those who planned the program in considering the entire field and in drafting an outline. This has resulted in a monumental piece of work; unified, well articulated, rich in details, yet having also emphasis, balance, proportion and significance.

There are historical papers, giving accounts of the development and diversification of power from the earliest times; geographical papers, marking out natural zones and boundaries; papers that stress the economic factors; the sociological features; the educational findings; the technical developments and difficulties. There are broad and more restricted surveys, covering records of existing practice and recommendations for improvement and development. Many of these show the training and special technique of the skilled survey maker.

There are many attempts to correlate power development with other activities—both with engineering and with those farther afield. There are theoretical papers, outlining more or less widely accepted causes and effects —and there are extremely practical papers, giving concrete instances of the application of power to industrial, agricultural or household problems. There are romances of research and of individual achievement, and great revealing visions of what will or may come.

Facts Rule

There are records, charts, photographs, tables and formulas that stand for actual, condensed, often standardized successful procedure—and there are word pictures that bring back a man, a workplace or a stroke of genius in a few happy phrases.

But always there is the feeling that whatever is said rests on fact, has been submitted to the relentless measurement of the engineer.

The reader interested in getting the largest amount of information in the most orderly way would doubtless sort the papers according to subject, and proceed to read and digest according to a well thought out plan. But an incalculable amount of pleasure and variety of impression can be obtained by reading them in hit or miss order, then sorting them for review and filing.

To turn from a study of the application of power to air transport to studies of power resources of, say, Finland, China, Russia, the Dutch East Indies, Rhodesia and Czecho-Slovakia; to read of standardization, then of the financing of loans for power development; of heat; of handling rubbish; of turbines; of illumination; of the place of publicity; of psychotecnics; of ship building; of paper making; of irrigation; of steam generation; of super-power; of dams,—this is to be carried fast and far through the powers and principalities of earth, fire, water and air!

The American papers are extremely creditable. Fine surveys of national and regional resources. Clear statements of the economic aspects. Detailed accounts of each type and field of development.

There are many significant pictures and phrases. Mr. Low's picture of the work room of Isaac Watt and his description of the place power plays in the life of each of us. Mr. Murray's definition of super-power, and his outline of what it can do. Mr. Hadley's clear-cut presentation of state versus private ownership. Mr. Rice's sketches of the romance of research. The fine enthusiasm of the British presentation of "Ship owners and Ship builders" and "Sail." Mr. Hoover's keynote paper on "Government Policies in Relation to Power Development and Deterioration," in which he depicts Government not only as what we wish it were, but what he feels it can be!

The fine and inspiring British phrase, describing efficiency which, "If viewed in a broader standpoint, can be considered from a national and from a commercial standpoint as measures of an approach to certain ideals." The equally telling, witty appeal for publicity by picturing the research scientist as usually regarded by the public as part "comic hermit" and part "superplumber." These stick in one's mind.

This body of literature will probably be regarded by future students as a priceless, accurate record of conditions today. In fulfilling its aim to serve as a universally usable, co-operating series of presentations of actual and potential natural resources, of living and working conditions everywhere the papers have timely interest and will have enormus historical value.

The Inspector

By William B. Wessels

Old Job he hadn't a thing on me
  Though misery bent him double.
My life is sad as life can be
  And my every-day name, trouble.
I'm the target for the whole blame bunch,
  I'm the regular grouch collector,
I'm sort of a bag for the crowd to punch,
  For I am a poor inspector.

The fellows say I'm a cat-eyed grump
  With an ingrown disposition,
The boss says I'm a careless chump
  Whose sight is in bad condition.
From the pattern shop to the shipping room,
  From water boy to erector,
The whole gang adds to the murky gloom
  In the life of a sad inspector.

The foreman surely has woes enough,
  The supe has a few to hold him,
The manager's job is sometimes tough,
  When worries and cares enfold him.
But mine's the worst of the lot, because
  I'm kind of a shop-dissector,
Whose cussed for finding or missing flaws,
  A widely abused inspector.

Well, the fellows bark, but they never bite
  And it's all in the job; you said it.
So I'll try to see that the work is right
  And certain to do us credit,
For a bum job never was useful yet.
  And—being the flaw detector,
I reckon I'll do my best, you bet,
  In the style of a real inspector.

Fiat Automobile Production Methods

By J. A. Lucas and F. E. Bardrof

Methods used in machining the top section of the crankcase—All crankcase parts are aluminum castings —Various milling, drilling and reaming operations

ALL THE crankcases for the Fiat automobile motors are made of aluminum, properly designed to give the necessary amount of strength and rigidity to the engine and providing a motor of comparatively light weight. The major parts of the crankcase include the top and bottom sections, the front cover over the timing sprockets, and the crankshaft bearing caps. In this article some operations on the top section will be illustrated and described, leaving the completion of the crankcase for the next installment.

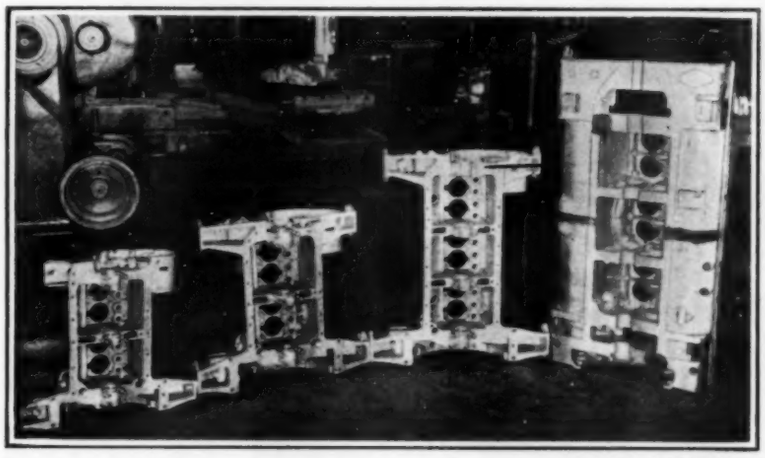


Fig. 47—Upper crankcase sections for various models of Fiat cars

The top sections for the crankcases for four models of the Fiat car are shown in Fig. 47. These parts are completely machined and have the bearing caps fitted. The one at the left is for the small four-cylinder model No. 501, the smallest model made by Fiat and a car with an exceptional record for economy in operation and upkeep. The next section is from a model 505, four-cylinder car, a somewhat larger model than the No. 501. The third crankcase is for the model 510, six-cylinder motor, and the fourth is the model 519, the largest and most powerful of the line. The latter is a new model and, although its power, speed and comparatively high gasoline consumption make it more adaptable for a country where fuel is cheap, none of these cars has yet reached America.

The three standard models are all shown in the illustration with their front ends uppermost, and the space for the timing sprockets and chain can be seen, together with the cylindrical casings that support the generators. Three bearings for the crankshaft are provided on the four-cylinder models, the six-cylinder model having four.

The first operation on the crankcase castings is the surfacing of the flange against which the bottom section fits. This operation is being performed on top sections for crankcases for the 501 model in Fig. 48 and the machine is an Ingersoll milling machine. The top of the case and the various horizontal pads for attachment of other parts are also machined on Ingersoll machines. The castings are held on the table of the machine in heavy fixtures, designed to make the loading and unloading of the machine quick and convenient.

The connecting rod holes are bored as shown in Fig. 49. The casting is placed on a locating plate on the table of the machine and held securely by a bar passing over the top. A special multiple-spindle boring head is attached to the spindle of a Fiat drilling machine and the four holes are bored simultaneously. To insure accuracy the boring bars have pilots that enter guide bushings in the work-holding plate.

Another drilling machine made by Fiat and

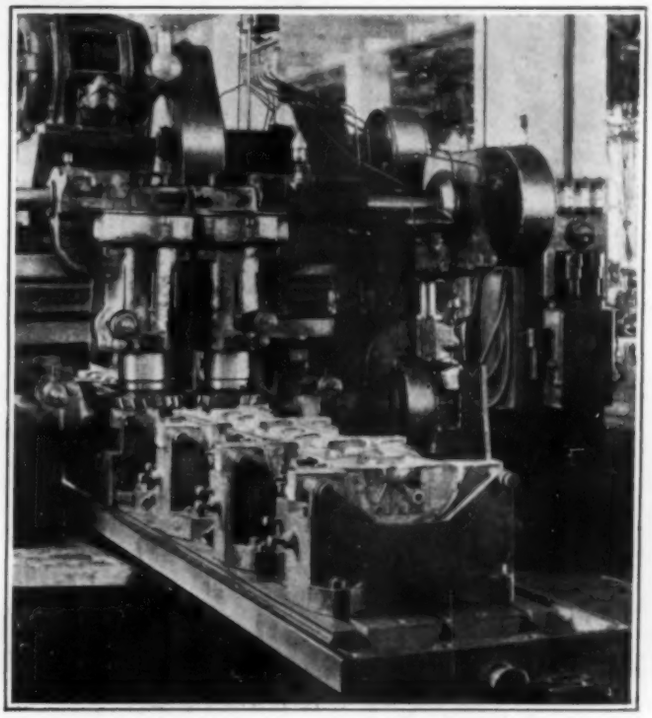
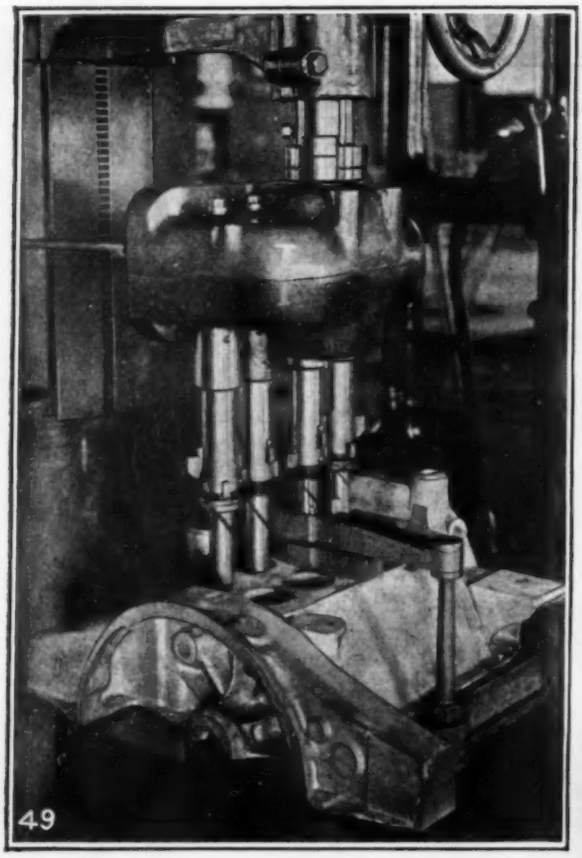
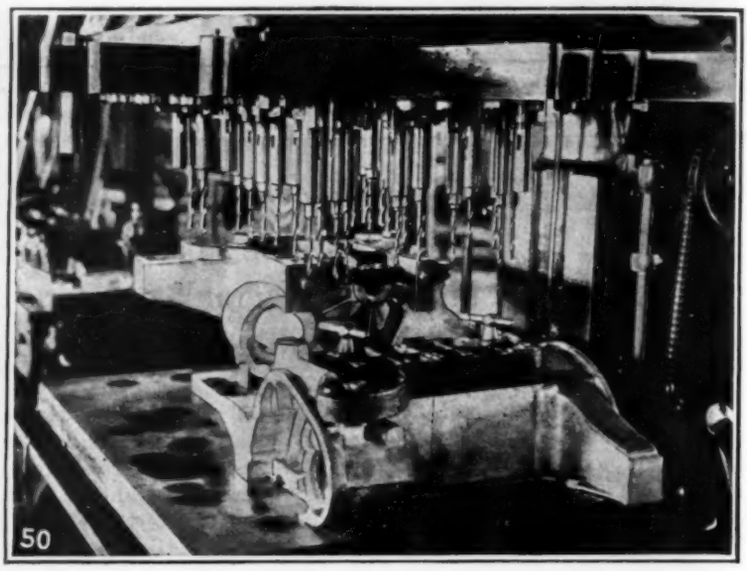
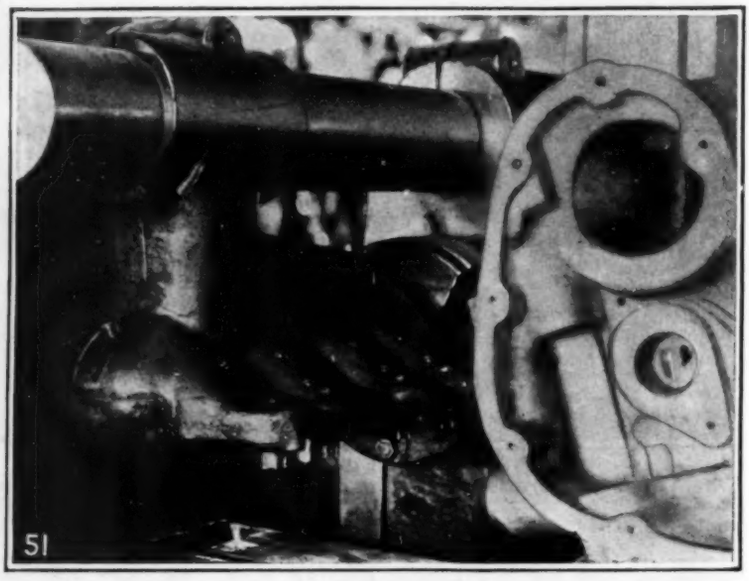


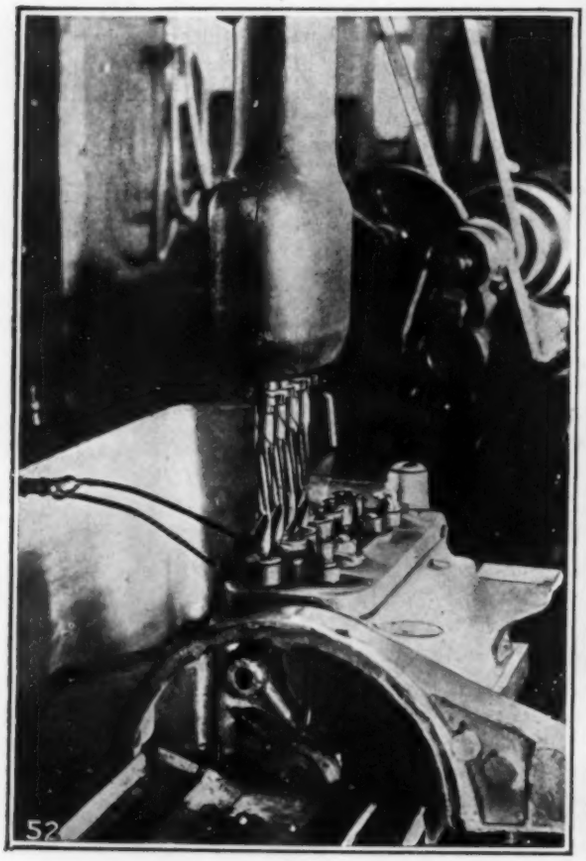
Fig. 48—Ingersoll milling machine surfacing crankcase sections

This is the ninth article of the Fiat series. The eighth article was concluded on page 160, Vol. 61, No. 4.









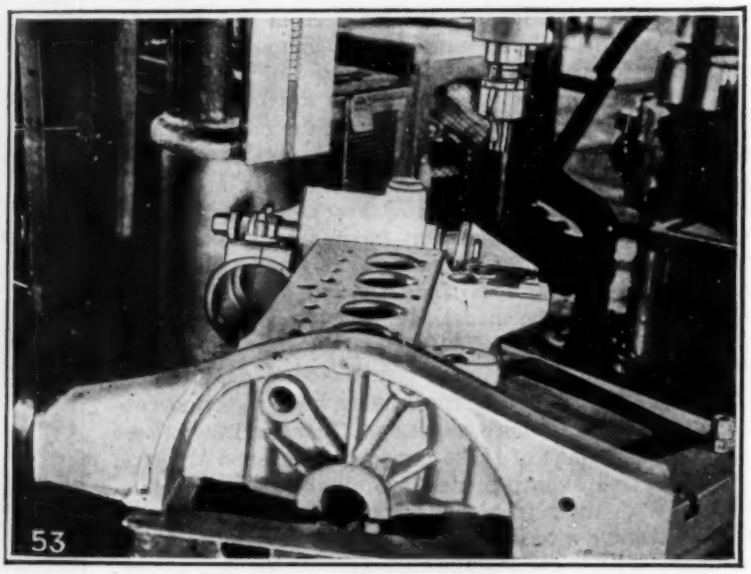


Fig. 49—Set-up for boring connecting rod holes. Fig. 50—Drilling bolt holes on a Fiat drilling machine. Fig. 51—Special milling head for connecting rod clearance slots. Fig. 52—Combination drills and reamers for valve lifter guide holes. Fig. 53—Countersinking operation

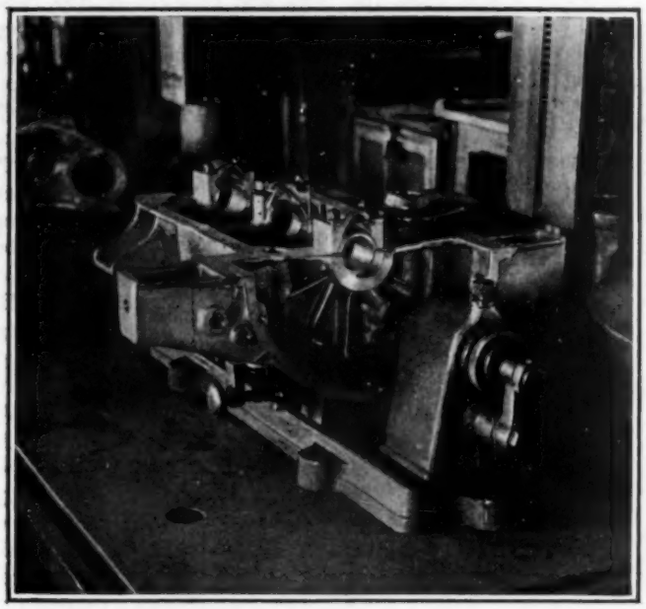


Fig. 54—Jig set-up for finishing oil-pump shaft bearing

of the multiple-spindle type is illustrated in Fig. 50, and the operation is the drilling of the bolt holes in the top and bottom of the upper section of the case. The holes are drilled in the top of one casting and the bottom of another at the same time, the two parts being mounted side by side on the table of the machine, as shown. The section which is being drilled on the bottom is held in a suitable locating fixture, the other being placed directly on the machine table. Simple plate jigs are positioned by the bored holes for the connecting rods and are held on the castings by screw clamps in these holes.

When describing the manufacture of the cylinder block, the machining of a slot at the bottom of the bore for connecting-rod clearance was mentioned. In Fig. 51 the machine is set up to cut the matching slots in the top of the crankcase. The multiple head is shown to better advantage in this photograph and the four stationary arms carrying the vertical end-milling cutters at their outer ends can be seen. The crankcase is held in a fixture in a tilted position, as shown, and the cutters machine the slots at one side of the connecting-rod holes as the work is fed toward the left. The positions of the finished slots are shown in Figs. 55 and 56.

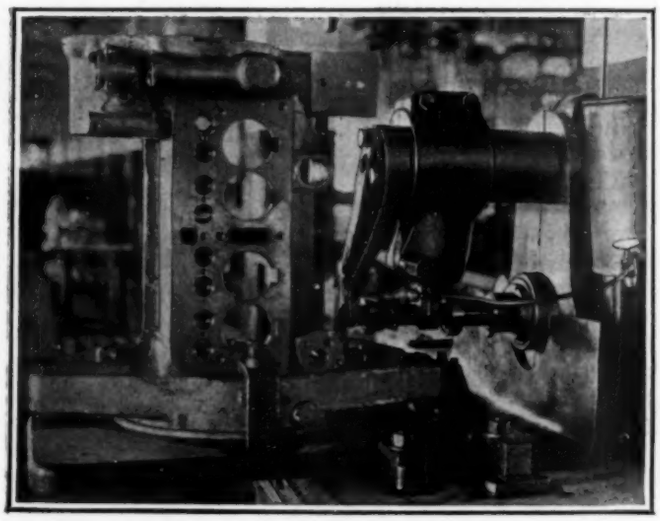


Fig. 55—Milling clearance in steering gear boss

Another special drilling head is shown in Fig. 52 attached to a machine of Fiat make. The operation is the drilling and reaming of eight locating holes for the valve-lifter guides which are attached to the top of the crankcase. The head is provided with four combination tools, the bottom ends being drills and the upper sections reamers. The tools rotate at high speed and four holes are drilled and reamed quickly. The work is then shifted longitudinally and the other four holes are machined.

The holes for the valve-lifter guides are coutersunk, and the case illustrated in Fig. 53 is arranged for this operation. The countersinking tool is of the built-up type with inserted blades and one hole is machined at a time. The jig shown in position at the front end of the casting is for drilling the holes for the magneto attachment bolts. This jig is located in the bearings for the horizontal shaft that drives the magneto and the water pump. The pump is located on the left-hand side of the crankcase immediately above the casing that holds the generator in position, and the water passages are bored in the bosses above the horizontal shaft, the top of the vertical boss connecting with the water connection in the cylinder block fan bracket.

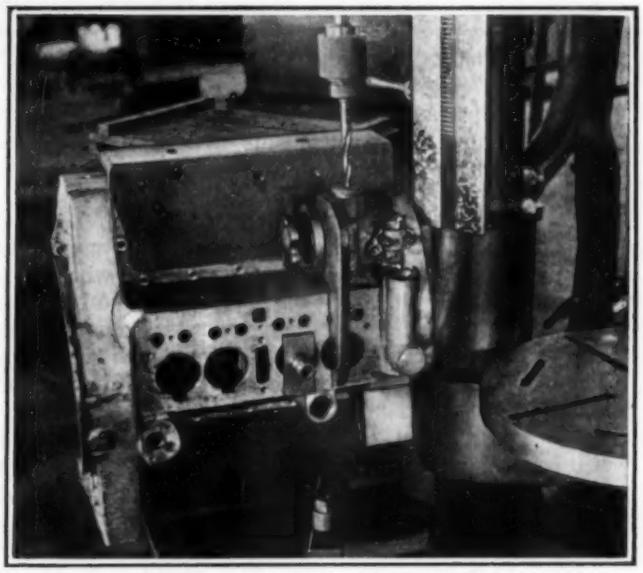


Fig. 56—Arrangement for drilling generator clamping bolt hole

The crankshaft bearing caps have been attached to the case as shown in Fig. 54, and the part is set up for the drilling and reaming of the bearing for the vertical shaft that drives the oil pump. The jig bushing will be noted just at the left and beyond the first bearing cap.

The milling operation illustrated in Fig. 55 is being performed on the pad to which the lower end of the steering mechanism is attached. The depth of the cut is controlled by means of a ball bearing mounted on the cutter arbor next to the machine spindle. As the table of the machine is fed upward this bearing comes in contact with the saddle shown attached to the table directly beneath it.

The drilling of the hole for the generator clamping bolt is shown in Fig. 56. The jig has a cylindrical plug that fits the generator recess and a long arm that projects over the top of the crankcase positions the drill bushing properly.

Notes from the Backwoods

Dear Mr. Editor:—

Some time ago I got hold of a book that was headed "Waste in Industry" and it made me set up and take notice. It said that the waste in business is something awful.

Being away back here in the red brush I do not know much about the shops out in the big world only what I read about them, and from my reading I have thought that they were all pretty fine, at least when compared with a Corn Sheller shop. Of course I know that some of them have been losing money by hanging on to old machines (I read your paper right along), but I thought that maybe they didn't have the money to buy the up to date ones. That could hardly be counted as waste against them, at least until there was some way that they could raise the money.

That waste end of business seemed to figure about fifty-fifty with the non waste, or some way around about that. Now I know that you can find good nuts, and washers, and broken files and such things where they should not be put but not enough to account for that amount of waste, so I went on reading and found out that they were blaming most of the waste on the fellows that were managing the businesses. It would seem that they had come to the conclusion that at least 75 per cent of the blame belonged there.

What's in a Name

That certainly looked bad for the business managers and I begun to wonder who the men were who made the charge. Near the front of the book I found a place where they had all signed their names. There were eighteen names. I could read five of them with certainty.

Nine of the balance I could guess at with more or less assurance, but could not be sure beyond a reasonable doubt. Four I could not even guess at. They were beyond my ability. Now, these men are high grade men. I suppose they are the smartest men that can be found for they have been given the job of telling us how good or bad the industries of the country are run. In a sense they acted as a grand jury. They heard such evidence as seemed proper to themselves, and from that evidence they made the charges against the industries.

Men who would be given that power with the backing of the Engineering Societies must be the pick, so I should think, of those societies, and it would follow that they must be highly efficient, or at least as efficient as an ordinary working man or about 75 per cent.

If it is fair to judge them by their handwriting they would not average up to even 25 per cent. I think that an average rating of 15 per cent would be about right. About the first thing that a child learns to write is its name, and it keeps on writing it. In ordinary writing there is a chance to guess at some words because they are used in connection with other words. With a name it is not safe to assume anything in connection with it. Names come from a diversity of languages and it is often difficult to get a name right unless every letter in it is clear and distinct, and cannot be mistaken for any other letter. The writing of his name by a man would be one of the most important of his writings and therefore the way it was done should be a good measure of the man with relation to his dealings with other men.

When I first read the book and thought of the conclusions that this committee had arrived at I felt very much discouraged. If the great industries of the country showed so much waste and the management was on so low a plane, what must the little one out here be like?

I could see, in my mind, that as soon as one of these engineers got a glimpse of it he would start in competition with me and with 50 per cent waste and 75 per cent bad management, plus the per cent that I am poorer than these good shops in his favor, where would I be with my microscopic margin of profit?

Then another thought came to me. How should efficiency be figured between the man who has one thing to do and the man who has many?

Is this right? One thing 75 per cent efficient. Two things 75 per cent efficient in each, 100 per cent by 75 per cent by 75 per cent is 56 per cent, etc. If this is right then a man who has a great many things to be efficient in might show a low end efficiency as judged by some standards and still be in the running.

Some of these standards of comparison make me think of a man I worked for when I was an apprentice. He was on contract work. The management turned me over to him. I was running a drill press. After a while I asked him for other work. "When you can do as much and as good work as Jack you will be changed," he said. I went after Jack's record and it was some time before I equalled it and again went to him for a change.

He gave it to me and for a time I was satisfied, but in time I wanted another change. Jack ran a small lathe, and so did I, and I felt that I was his equal. "When you can do as much and as good work as Enos you will be changed," he said. Enos was the best man he had on small lathe work. He wasn't good for anything on drill press work. This man's system was to rate me against the best man that he had on the job he was rating. Naturally I stayed quite a while on each job. Now, if each of these men were 90 per cent efficient, and if there were five of them, and if I was as efficient as each of them I would be 90 x 90 x 90 x 90 x 90 equals 59 per cent efficient.

I may have the wrong slant about all of these things, and illegible writing may be the sign of genius, and it is likely that the ones who do the worst writing will be the least apt to read this even if you should be so rash as to publish it, so it may be that in writing it I have only shown another sign of backwoods inefficiency.

W. Osborne.

Camera for Plotting Fall of Shots

Successful results have been obtained with a camera obscura built by the Bureau of Standards, Department of Commerce, for plotting the fall of shots on the small arms water range at the Aberdeen Proving Grounds. Two others like it are to be built. In principle this instrument is a large camera in which tracing cloth takes the place of the film or plate. The observer watches for the splash of the shots to appear in the image on the screen and records their location. Floats are placed at fixed distances apart to mark the range, and the camera obscura is mounted in a tower about fifty feet above the water.

The splashes of the shots were found to be easily visible on the screen, and their positions could be rapidly and accurately recorded.

How to Estimate Machine Shop Costs

By Albert A. Dowd

Estimates of machining time on spline milling operations — Practical examples of keyway and slot cutting—Gear milling and hobbing estimates

THERE are a great many different types of milling machines and, although the cutting action is similar in various milling operations, there are points of difference in their application that must be considered when making time studies for the various types. Some machines are particularly designed for a certain kind of operation and their feeds and speeds are so proportioned as to handle this work to the best advantage. Among these special types is the spline milling machine, designed particularly for milling keyways or slots which may be shallow or deep or may in some cases pass entirely through the work. Spline milling machines are semi-automatic in their action and only require the operator's attention when setting up and removing the work.

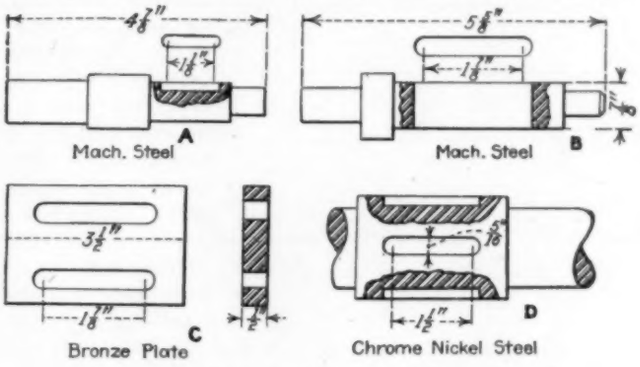


Fig. 27—Spline milling work for time study

Keyways cut on spline milling machines are rounded on each end to a radius equal to that of the cutter. The work is held on a table which reciprocates between two adjustable opposed spindles, and these spindles are fed into the work at the end of each stroke of the table. The ordinary type of end mill is not suitable for this kind of work because the teeth do not run to the center of the cutter, so the form of cutter generally used is a "fish-tail" type. Cutters of this kind are free cutting and can be fed directly into the work without clogging, as they have an abundance of chip clearance.

In addition to setting up the machine with the work in place, the operator must bring the table to the working position before he throws on the power. Work is often set up in pairs, since there are two spindles working and both are controlled automatically. Of course, if the slot extends entirely through the work, both spindles are in use at the same time on opposite sides of the same piece of work; in which case only one piece can be machined at a time.

The material to be cut makes some difference in the time study, although not as much as on some other kinds of milling operations, because the machine spindle speeds are somewhat limited. The feeds are much lighter than on other milling operations and the cutter speed can consequently be somewhat greater. In this kind of cutting the chips are removed almost as a powder because of the light feeds and high speeds used.

The length of the cut and the time taken for each stroke of the table are important points and the first determines the second to a great extent. A long cut requires a greater length of time for each stroke than a short cut and the strokes per minute will be correspondingly reduced. Since the feed takes place at the end of each stroke, the number of strokes necessary is determined by the depth of feed at each end of the cut.

Let us assume

D = Depth of cut
F = Feed per stroke of table
S = Strokes per minute

then $\frac{D}{F}$ = number of strokes required to complete the cut.

If we know the number of strokes per minute at which it is possible to run the machine for a given cut, the time required is found by using the following formula:

$$\frac{D}{F \times S} = \text{Time in minutes}$$

As spline milling machine time studies are quite different from those on other machines, a few examples are

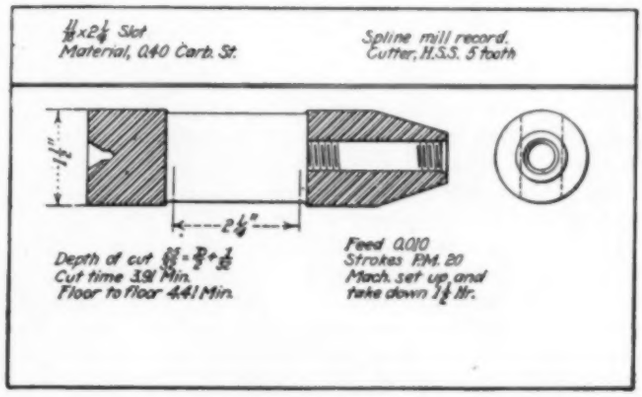


Fig. 28—Record card for spline milling work

This is the tenth article of the series. The ninth article was concluded on page 000, Vol. 61, No. 00.

shown in Fig. 27. Part *A* is a machine-steel shaft having a keyway $\frac{3}{8}$ in. wide by $1\frac{1}{8}$ in. long. The material being machine steel and the feeds very light, the speeds can be about double those noramlly used for milling. If we assume a cutting speed of approximately 120 ft. per min. for the cutter, we find that 1,280 r.p.m. will be required, but the nearest machine speed which can be obtained is 1,500 r.p.m., giving a cutting speed of about 140 ft. per min. We must either use this speed, or take one very much slower and reduce the production materially. The next step is to decide upon the feed at the end of each stroke and a conservative estimate will be 0.003 to 0.005 in. Each cutter tooth can easily take a cut of 0.005 in., or 0.025 in. per revolution with a 5-tooth cutter. Some cutters are made with 2 teeth and others are made with 4 or 5, but in either case it appears possible to take a feed approximating 0.025 in. per cutter revolution. The length of the cut is 1.125 in., and $\frac{1.125}{0.025} = 45$, the number of cutter revolutions per stroke of table. From this data we can determine the number of strokes per minute. If we are running the cutter at 1,500 r.p.m., then $\frac{1,500}{45} = 33$, the number of strokes per minute for the table. We find, however, that the greatest number of strokes obtainable is 30 and by applying the formula

$$\frac{D}{F \times S} = \frac{0.1875}{0.005 \times 30} = 1.25 \text{ min.}$$

It must be remembered that two pieces are set up at a time for spline milling work of this kind, a simple fixture which the operator can manipulate rapidly being used. We can allow 0.60 min. for setting up and removing the work and for incidental time. The total time, therefore, is 1.25 + 0.60 = 1.85 min. for two pieces or 0.93 min. for one piece.

In the next example *B* we have an entirely different kind of work, as the slot goes entirely through the piece and only one part can be handled at a time. One of the spindles stops before reaching the center, while the other continues and removes the thin web at the center of the piece, so in figuring the length of time necessary for this kind of work the total depth of cut should be taken as a trifle more than one-half the diameter of the piece. In this case, since the diameter is $\frac{7}{8}$ in., it would be well to allow one cutter to run to a depth of $\frac{11}{16}$ in. The width of this cut is $\frac{3}{8}$ in. and the travel required is $1\frac{7}{8}$ in. The speed and the feed at the end of each stroke will be about the same as for example *A*. It would be well to use 20 strokes per min. as the cut is considerably longer.

$$\frac{D}{F \times S} = \frac{0.4685}{0.005 \times 20} = 4.68 \text{ min.}$$

The work is set up on centers and can be put in place and removed very rapidly, so an allowance of 0.40 min. is sufficient for setting and removing the work. The total time required is 4.68 + 0.40 = 5.08 min.

In the example *C* there are two $\frac{1}{4}$x$1\frac{1}{8}$-in. slots in the rectangular bronze plate and two settings will be required. There are two methods of handling work of this kind, and the estimator must decide whether to machine all slots on one side first and then set up again on another fixture to machine the second slot, or to machine one slot and then the other in the same fixture using opposite sides of the blocks for location. Ordinarily it would be better practice to cut one slot first and use this for location in cutting the second slot. Assuming that accuracy is essential, two fixtures and two operations will be considered.

The material being bronze, we can safely use about 20 strokes per min. and a feed per stroke of about 0.005 in. The length of cut is 1.875 in. and the depth of cut is slightly over one half the thickness, say

$$\frac{D}{F \times S} = \frac{0.281}{0.005 \times 30} = 1.87 \text{ min.}$$

The allowance for setting up and removing work may be 0.4 min. and the total time is 1.87 + 0.4 = 2.27 min. This time must be doubled because there are two operations giving 4.54 min. for the entire piece. In a case of this sort the estimator should specify briefly the proposed method of handling.

One more example is shown at *D* in order to illustrate a 4-spline shaft. A job of this kind can be handled with two fixtures, one of which has sliding points for locating after the first operation, or by using an index fixture in which the work can be indexed 90 deg. after the first cut has been made. The second method is generally preferred because the work does not need to be removed from the fixture. The material of which this shaft is composed is chrome nickel steel, hard and very tough, necessitating fine feeds and moderate speeds. A cutter speed of 750 r.p.m. is high enough for this job and the feed can be about 16 strokes per min. The feed at the end of each stroke should not be too great, say about 0.003 in. Then, as the depth of the cut is $\frac{5}{16}$ in., we have

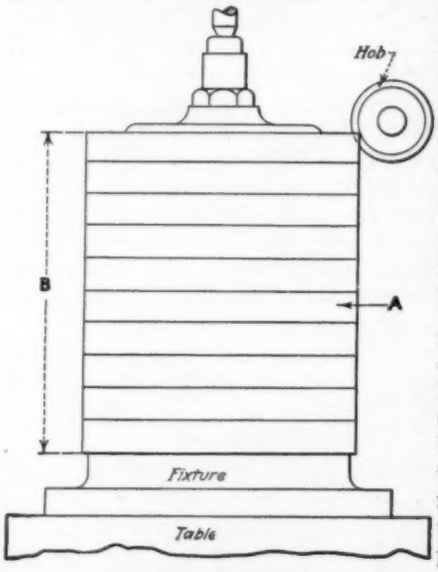


Fig. 29—Spur gears stacked for hobbing

$$\frac{D}{F \times S} = \frac{0.156}{0.003 \times 16} = 3.25 \text{ min.}$$

The work is set up on centers and the requirements call for an accurate job. As the work must be indexed after the first cut, we should allow 0.25 min. for this. The second cut is estimated at the same time as the first, and an additional allowance of 0.5 min. for setting and removing the work will give 3.25 + 0.25 + 3.25 + 0.5 = 8.25 min., which is the time required for each piece completed.

It will be found very profitable for the estimating department to keep a number of card records showing what speeds have been found practical on various kinds of work. Records of this sort are perhaps more important on this type of machine than on almost any other kind, due to the fact that there are so many variable factors in the speeds, feeds and strokes per minute used on different kinds of material. A form of card like that shown in Fig. 28 will be found convenient for spline milling operation records. A very simple outline drawing or even a free hand sketch of the part to approxi-

mate scale is sufficient to give all the information necessary. It is advisable to file the card according to the width and length of the slot rather than by the customer's name or the name of the part.

Work which is spline milled, is often called for in comparatively small lots, hence the set-up and removing time for fixtures and cutters must be given consideration and the estimate should be summarized to cover all contingencies. When large lots are considered the actual production time should be gone over carefully to guard against loss, making all due allowance in the summary for contingent time, breakage of cutters, etc. Then do not increase the estimate by adding a percentage to it unless satisfied that work cannot be produced in the time specified. Adding too much percentage to a finished estimate, shows a lack of confidence in the figures obtained and the addition may be the cause of losing the job. This rule applies equally well to all estimating jobs.

Data for Machining Gears

The maching of gears in quantities is a production proposition which usually involves not only the cutting of the teeth but also turning, boring, cutting keyways, and often hardening and grinding operations. Unless the shop is well equipped for gear cutting with thoroughly modern and specialized machine tools, such work involves keen competition with firms which specialize in gear cutting. There are a number of factories about the country, which do nothing else but make gears of all kinds and savings can frequently be effected by having the gear cutting work done by them. For short jobs, unless well equipped, it would often be cheaper to have the work done outside.

Considered broadly, the cutting of gears is either a milling or a planing proposition, depending partly on the form of gear required and partly on the method preferred. For example, spur gears can be milled by a regular gear tooth cutter, hobbed by a special hob, or shaped on a gear shaper. Spiral gears can be either hobbed or shaped, but worm gears must be hobbed. Bevel and miter gears can be milled or generated on a special gear tooth planer, the milled form not being considered as true and accurate as the generated or shaped form of tooth.

For gears made in small lots the teeth are often milled, either on a milling machine using an index head for the spacing of the teeth, or on a gear cutter or hobbing machine. Small bevel gears are also often held on an index head in a milling machine when made in small lots. Large bevel gears are almost invariably ordered from a manufacturer specializing in this work, unless the factory is equipped with bevel gear generating machines. For milled or hobbed gears in small quantities, the estimator may consider the job as a milling proposition and figure speed and feeds according to milling practice, taking into consideration the accuracy required, the kind of material and pitch.

Cast iron gears having a diametral pitch of 2½ or finer can usually be cut within the requirements of commercial accuracy, with one cut, using a high speed steel cutter. Steel gears can be cut at 35 to 50 ft. per min. The feed may be from 0.003 to 0.006 in. per tooth of the cutter. Steel gears can be cut at 35 to 50 ft. per min. using a feed of 0.002 to 0.004 in. per tooth of cutter, depending on the alloy. For accurate work two cuts are often required, the first of these being a "stocking" cut to remove the gerater part of the material and the second for finishing at considerably higher speed than the roughing cut. Gears with a diametral pitch larger than 2½ usually require two cuts in order to obtain the required accuracy.

Small bevel gears are often cut on a milling machine or gear cutter, but the larger sizes are generally roughed out first by milling and afterwards cut accurately on a gear shaping machine. In estimating the cutting time on large bevel gears, the milling cut is figured according to the length of tooth plus the approach, as in regular milling estimates. This amount multiplied by the number of teeth in the gear plus the allowance for indexing gives the cutting time, and the time required for setting up and removing the work must be added. In stocking out bevel gears a cutting speed of 50 to 60 ft. per min. can be used for high speed steel cutters with a feed of 0.005 to 0.012 in. per tooth. For alloy steels, roughing cuts can be made at 35 to 50 feet per minute with a feed of 0.003 to 0.006 in. per tooth of cutter. The following formula can be used for roughing out bevel gears:

$$\text{in which cutting time} = \frac{(L + \frac{C}{3} \times N}{F \times R}$$

R = R.p.m.
L = Length of tooth cut
C = Diameter of cutter
N = Number of teeth in the gear
F = Feed per revolution of cutter

For example, in roughing out an alloy-steel bevel gear having 48 6-pitch teeth and a 1½-in. face, a roughing cutter 3 in. in diameter and having 12 teeth may be used. If we allow each tooth to feed 0.004 in., then 0.048 in. will be the feed per revolution. Cutting speeds can be taken at approximately 40 ft. per min. corresponding to 50 r.p.m. of cutter. Substituting these values the cutting time is

$$\frac{(1\frac{1}{2} + 1) \times 48}{0.048 \times 50} = \frac{120}{2.4} = 50 \text{ min.}$$

With a gear cutter 3 sec. can be allowed for indexing and drawing back the cutter between each cut giving 2.4 min. for the 48 teeth. With an allowance of 2 min. for setting and removing the gear the total time per gear is 54.2 min. If a single-spindle machine is used, this would be the time allowance for roughing. If a three-spindle machine is used, the time for three gears would be the same, except for the setting up of three gears which might require 4 min. The time per gear would then be

$$\frac{50 + 2.4 + 4}{3} = \frac{56.2}{3} = 18.7 \text{ min. each.}$$

It must be remembered that this estimate is for roughing only. If finished on a bevel gear generating machine, the time for finishing each tooth might average 45 sec.; then $\frac{45 \times 48}{60} = 36$ min. each will be the cutting time, to which must be added the indexing time of 2.4 min. The total then would be $36 + 2.4 + 2 = 40.4$ min. each. We have found that the roughing operation would take 54.2 min. on a single-spindle machine or 18.7 min. on a three-spindle machine. The total time estimate will then be $54.2 + 40.4 = 94.6$ min. for the single-spindle machine, or $18.7 + 40.4 = 59.1$ min. for the three-spindle machine.

When spur or helical gears are to be hobbed, a great deal depends upon the method of setting up. If a number of gears can be placed on an arbor as shown at *A* in Fig. 29, the total length of cut is *B* and depends on the number of gears set up. It is of the greatest importance in gear cutting that the gears should be supported very solidly, so that there is no chance for vibration and so that points directly under the cutter are very rigid. In using this method of setting up, the cutting speed of the hob controls the speed of the gear group and the feed varies according to the material cut, the nature of the cutter, and the rigidity of the set-up. In hobbing spur gears, the feed of the hob per revolution of the gears varies greatly, 0.010 in. being the minimum speed used and 0.150 in. the maximum. The minimum speed is used only for very hard and tough materials, while the latter is used for the softest grade of cast iron. If we remember that the hobbing process is nothing more than a milling cut combined with a revolution of the gear, we can easily determine a suitable speed and feed for the cutting operation.

Assuming that we have a 6-pitch, cast iron spur gear with 60 teeth to be cut by the hobbing process, and that the gears can be stacked close together, a hob 3 in. in diameter could be used and run at 100 r.p.m. with a feed of approximately 0.100 in. per rev. of gear being cut. If the gears are set up in stacks of 10 and are 1½ in. across the face, we have a total hob travel of 15 in., to which should be added one-third the diameter of the hob. The hob will revolve 60 times for each gear revolution. Using the formula given above for roughing bevel gears and substituting the numerical values, $\frac{(15+1)\times 60}{0.10\times 100} = 96$ min. cutting time. An allowance of 1 min. for incidental time and 5 min. for setting and removing brings the total time to 102 min., or 10.2 min. per gear.

In hobbing helical gears the process is the same but the feeds must be diminished as the angles increase. Up to about 40 deg. the feed can be about the same as for spur gears, diminishing about 50 per cent at 60 deg. and about 66 per cent at 70 deg. As the hob is set to the helix angle, the feed of the cutter is naturally increased by the turning movement of the gear blank, so that the greater the helix angle the greater the feed becomes.

The Roundhouse Foreman's Job—Discussion

By F. M. A'Hearn

JUST why a roundhouse foreman should assume that the majority of troubles connected with the operation of a railroad are centered around his job, is a rather interesting study. Consideration of the subject would sometimes bring out the thought that the mental attitude of the man toward the job is largely responsible for his belief that the job is hard, or otherwise.

I would not say that the job of a roundhouse foreman is an easy one by any means, for in most cases there are annoying conditions to be met. Nevertheless, a boiler-shop foreman or machine-shop foreman must experience many troubles not known to the roundhouse foreman. It does seem to be the popular belief, however, that the roundhouse foreman has many troubles.

In railroad work, as in all other lines, the logical way to avoid trouble is to remove the cause. Getting down to the conditions mentioned in the interesting article by R. W. Hamer on page 684, Vol. 60, of the *American Machinist*, the question arises as to whether or not the work report described is typical of what is received daily for each locomotive turned, or whether or not the report is an unusual one.

If the report is a fair description of the condition of the average locomotive turned at his terminal, Mr. Hamer is holding down a very unpleasant job, but if it is an unusually large one, the general condition of the power on the division may be excellent, and, as is often the case, a total of less than one-man hour of mechanical work may put a locomotive in condition for service.

At the present time many railroads are running locomotives on regular schedules of two, three, and sometimes four hundred miles without any running repairs, while other runs may approximate one hundred miles.

Numerous items in the report cited by Mr. Hamer, indicated exaggeration of conditions by the engineer making the report or else show a rather low standard of maintenance by the motive-power department. For example: Many of the parts reported should run from shopping to shopping for classified repairs without renewal, unless damaged; nevertheless we read: "Renew steps on front of engine; Renew end sill on front end; Repair false deck in tank; Renew springhangers; Renew generator and cab lights; Renew chafing iron between engine and tank."

The cab lights are subject to breakage and may need renewal at any time, but why a locomotive that is inspected every month should need such items as end sills, chafing irons, or steps renewed as part of daily work, unless damaged during the trip, is hard to understand. If necessary repairs are not made as reported after each trip or each day's work, proper explanation must be made on the work report for failure to repair the defects reported. The question then arises: Are these repairs necessary or are they wrongly reported by the engineer? Again: Did the parts reported, if in need of repair, become in that condition during the last trip prior to the report or are they conditions that have been previously reported and not been repaired?

If the report is a fair sample of the daily report received, the job of foreman at that point may be rather unpleasant. Even though the report cited indicates power conditions that exist on some railroads, I do not believe that this is a general condition of motive power throughout the United States.

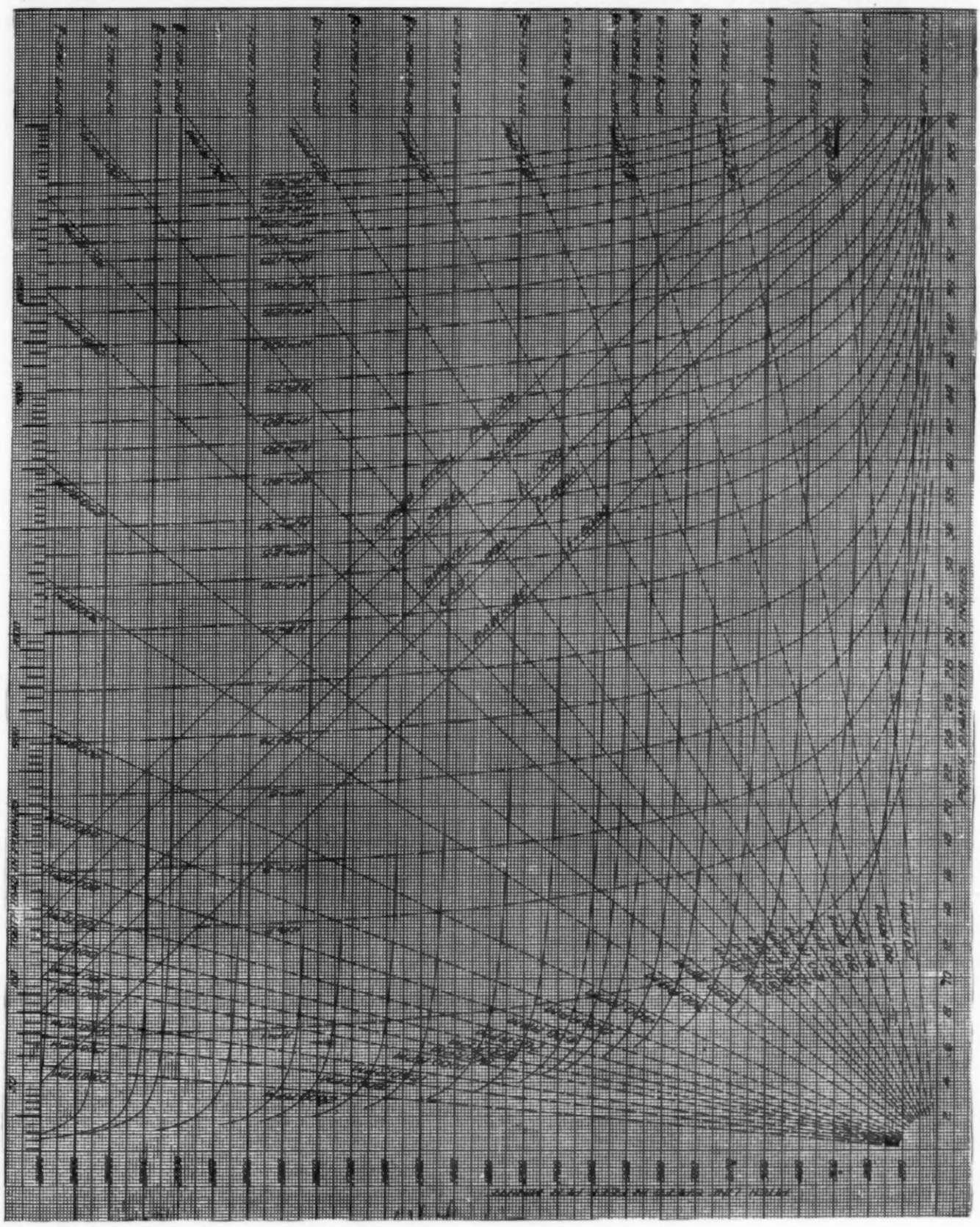
The roundhouse foreman holds an important position in the matter of power conditions and must at all times work for a high standard of maintenance. This requires that locomotives be carefully inspected and that work reported by the inspector or engineer be done in a workmanlike manner, and also that the foreman have confidence in himself and his department that difficulties encountered will be overcome. The mental attitude of men referred to in the first paragraph has the same influence in a workshop as in a baseball game, where, as we all know, confidence in the work of the team is the incentive for each man to do his best.

A Design Chart for Industrial Gears

By T. F. Stacey

THE American Society of Mechanical Engineers through its Joint Committee on the Standardization of Industrial Gears has recommended that the face width be fixed for each size of tooth. The face width recommended is approximately equal to 10 divided by the diametral pitch, the proportion generally accepted. However, fractions of an inch are taken as standard.

This standardization simplifies the design of gears



and, since it removes one of the variables from the equation, the chart on the opposite page has been plotted to include all the remaining variable factors. This chart permits the selection of the proper gear without any mathematical calculations.

The chart divides itself into three main groups, the first of which is the group of r.p.m. curves. These curves give the pitch line speed when plotted against the pitch diameter, the relation between the factors being shown by the following equation:

$$V = \frac{\pi DN}{12}$$

in which

V = Pitch line speed in ft. per min.;
D = Pitch diameter in inches;
N = R.p.m.

The second group is made up of the horsepower curves which show the tooth load in pounds as a function of the pitch line speed and the horsepower. The relation between these variables is given by the equation

$$W = P\left(\frac{33{,}000}{V} + 55\right)$$

in which W = Tooth load in pounds;
P = Horsepower.

This equation is a part of the Lewis formula and takes account of the velocity correction, or the allowable load on a given gear when run at different speeds.

The third group includes the curves of diametral pitch and fiber stress and is based on the equation

$$W = bf\left(\frac{0.389}{S} - \frac{2.15}{DS^2}\right) = \frac{0.389\,bf}{S}\left(1 - \frac{5.53}{DS}\right)$$

in which b = Face width;
f = Fiber stress;
S = Diametral pitch.

This is the Lewis formula for the strength of gear teeth. It was first plotted, for each value of S and an assumed value of 10,000 for f, between W and a vertical scale of pitch diameter. This curve was then drawn on the chart so that the vertical scale of pitch diameter was projected to the lower horizontal scale. The other curves of fiber stress were then drawn so as to obtain a direct proportion of the values of W, since the tooth load is proportional to the fiber stress.

Since all the variables are plotted, any problem may be solved, but the usual problem is to find the pitch and face of a gear when the horsepower, speed, and diameter are given. The dotted line on the chart gives the solution of this problem for a cast-iron gear whose pitch diameter is 22 in., and which is to transmit 7½ hp. at 100 r.p.m.

The 22-in. P.D. ordinate is followed vertically to the 100-r.p.m. curve. The horizontal line at this point is then followed to the 7½ hp. curve from which point we pass vertically to the cast iron curve, or curve for 8,000 lb. per sq.in. fiber stress. The horizontal line at this point lies between the lines for 6 and 7 diametral pitch, and the gear to suit the conditions of the problem will, therefore, have a diametral pitch of 6 and a face width of 1¼ in. The pitch line speed may be checked while following through the solution, in order that excessive speeds may be avoided.

The allowable fiber stresses given for the different materials are for average conditions and are recommended by gear manufacturers. Any unusual conditions such as shock load should be met by using a lower allowable fiber stress. The curves for pitch diameter are plotted for a minimum of 12 teeth. It is interesting to note the effect of undercutting on small pinions.

Book Reviews

Arc-Welding Handbook. By C. J. Holslag, Chief Engineer, Electric Arc-Welding and Cutting Co. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York. Cloth, 5x7½ in., 250 pages, 50 illustrations. Price $2.

A thorough and concise exposition of the art of arc-welding is included in this volume, beginning with descriptions of the distinguishing features of the various types of arc-welding machines and methods of operation, preliminary instructions as to dress, method of holding the electrode, etc. The methods to be followed in performing all the various kinds of welding operations are described, step by step, in a clear and practical manner that eliminates the element of mystery and gives the beginner a clear understanding of both the equipment and the processes. The book is well illustrated with drawings and photographs, showing how the electrode should be held for welding various kinds of work, how the parts should be prepared for welding, how the weld should appear after it is finished, and so forth.

The methods to be followed in the welding of cast iron, alloy steels and non-ferrous metals are also explained in detail and a chapter is devoted to useful expedients that are valuable in overcoming difficulties that often arise on unusual welding jobs. A chapter is also devoted to the subject of electric welding and its effect on the eye-sight and illustrations are included which show how the welding machines should be installed in various kinds of shops and what kinds of shields should be used in order to obtain the best results. In fact, practically every phase of arc welding is covered in a manner that will make the book valuable not only as a manual of instruction in welding for the beginner, but also as a guide for the engineer, foreman or others who may be in a position to supervise the work.

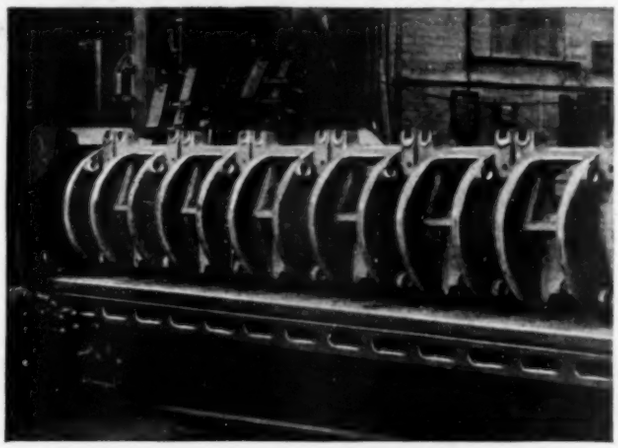
With the idea that the text may be useful in technical or trade schools where arc welding instruction is offered, questions have been added at the end of each chapter. The book closes with a dictionary of terms used in arc welding.

Shop Arithmetic. By Earle B. Norris, M. E. and Kenneth G. Smith. 257 pages, 6x9 in., 113 illustrations. Published by McGraw-Hill Book Co., New York. Price $2.

This is the second edition of this volume, which forms part I of an industrial-education series on shop mathematics prepared in the extension division of the University of Wisconsin. Two new chapters have been added to the original volume, which dates back twelve years and has run through seventeen printings.

The new chapters deal with logarithms and the slide rule which are explained in a very clear and simple manner. Examples that show the principles involved are carefully worked out and problems are given by which the student can check up on his actual knowledge of the subject. Both the use of logarithms and of the slide rule should be known to all who aspire to be engineers, while toolmakers, draftsmen and designers generally, not forgetting estimators, will find a knowledge of them very convenient at times.

The book is to be commended as one by which even the beginner can secure a grasp of arithmetic and can go as far as his ambition, or his need, urges him.

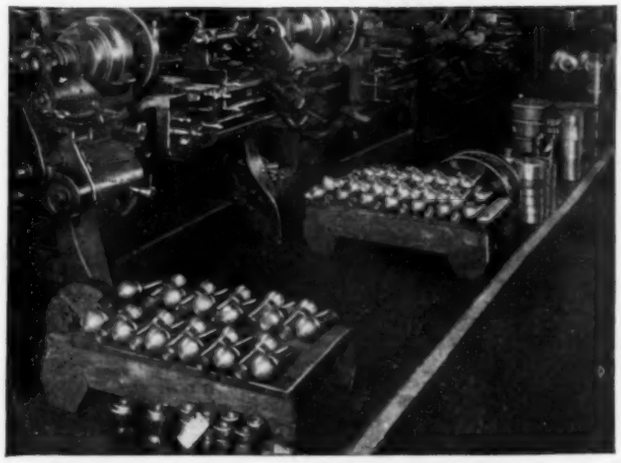


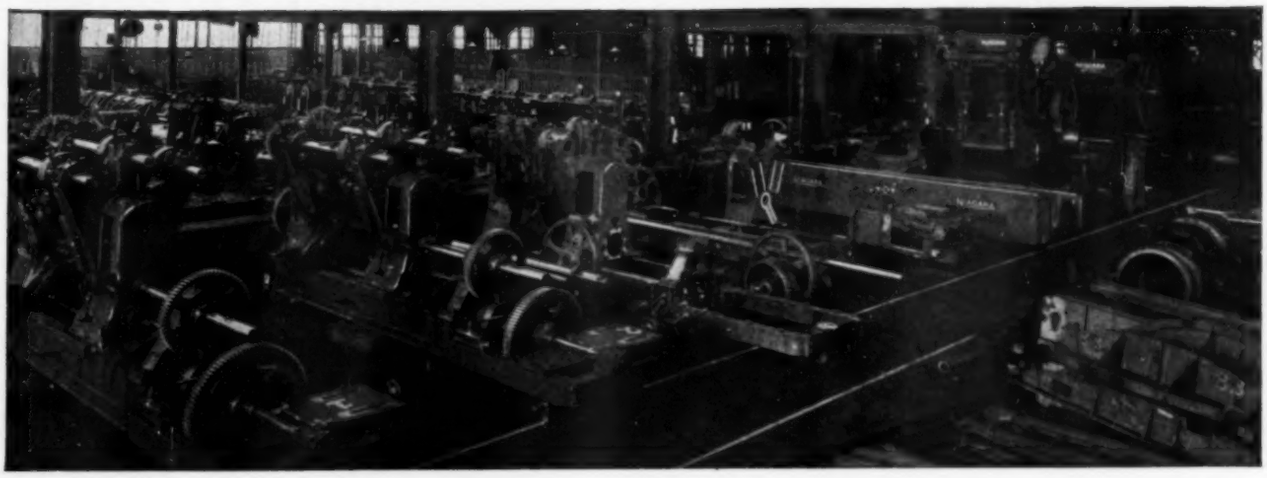
Where Machine Tools Are Made

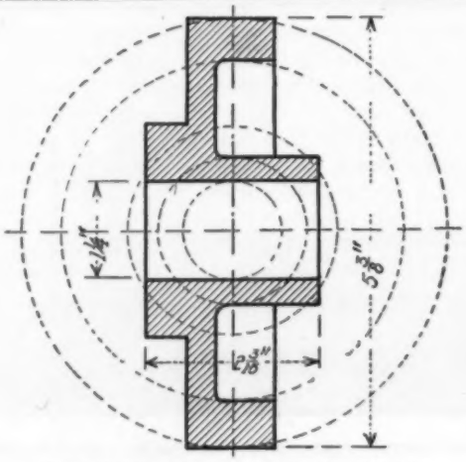
Niagara Machine & Tool Works

Buffalo, N. Y.

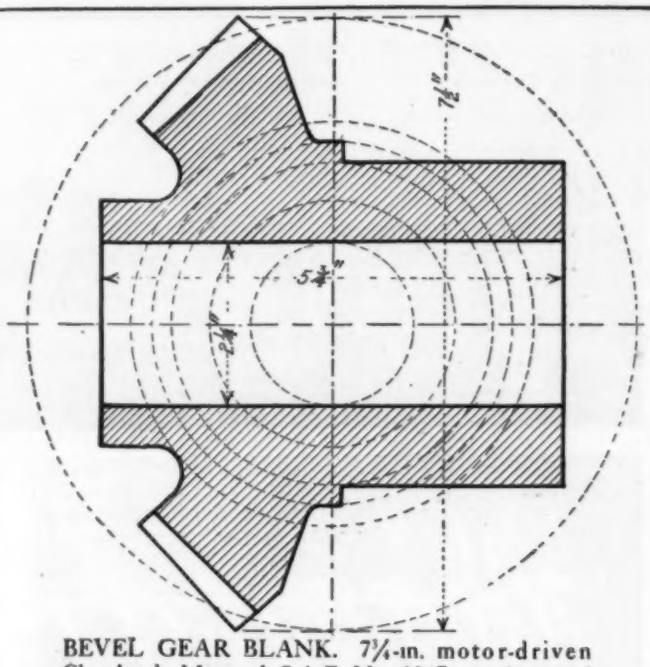
Founded 1879 as Niagara Stamping & Tool Co.



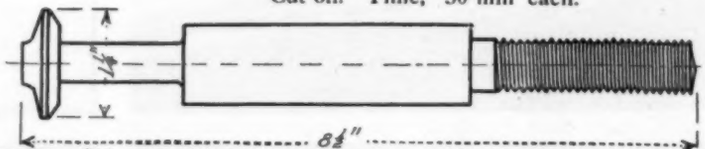




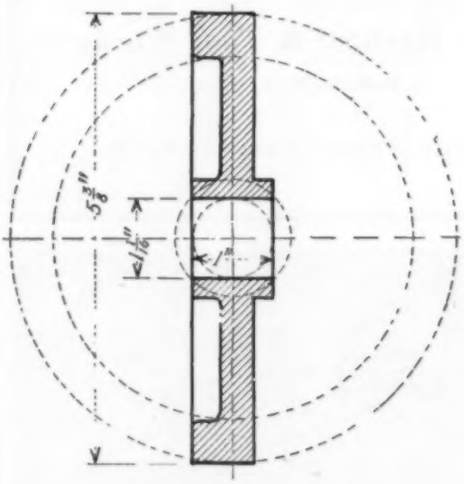
GEAR BLANK 5½-in motor-driven Cleveland. Material, S.A.E. No 1020 cold-rolled steel Operations: 1—Feed stock and gage to length. 2—Drill, rough turn and rough trepan 3—Bore and form. 4—Finish trepan 5—Ream. 6—Cut off. 17 min each



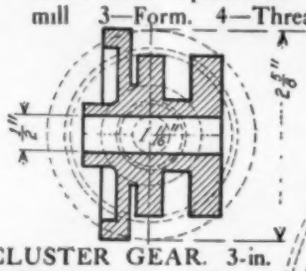
BEVEL GEAR BLANK. 7¼-in. motor-driven Cleveland. Material, S.A.E. No 1045 rough-turned steel. Operations: 1—Feed stock and gage to length. 2—Drill, turn and form half way. 3—Bore and form to size. 4—Trepan. 5—Ream. 6—Cut off. Time, 30 min each.



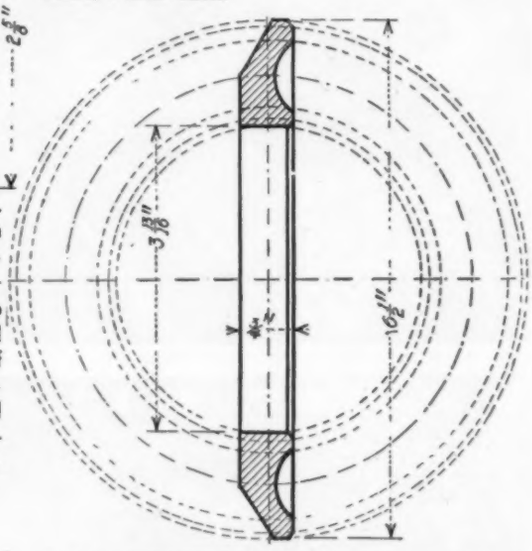
SHAFT 2½-in double-range, motor-driven Cleveland. Material, cold-rolled steel. Operations: 1—Feed stock and gage to length. 2—Box mill 3—Form. 4—Thread with self-opening die head. 5—Cut off. Time, 4 min each.



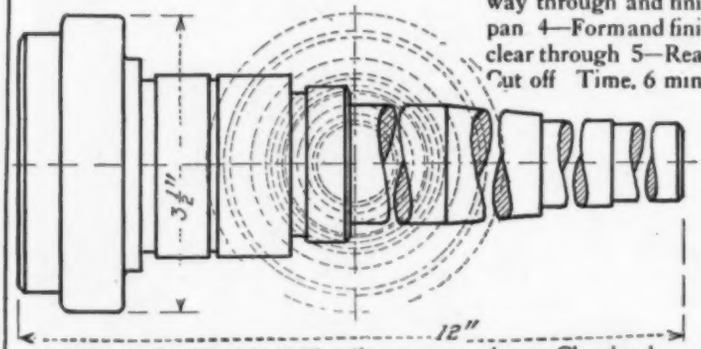
GEAR BLANK 5½-in. motor-driven Cleveland. Material, S.A.E No 1020 cold-rolled steel Operations: 1—Feed stock and gage to length 2—Drill, rough turn and rough trepan 3—Bore and form 4—Finish trepan 5—Ream 6—Cut off Time, 12½-min each.



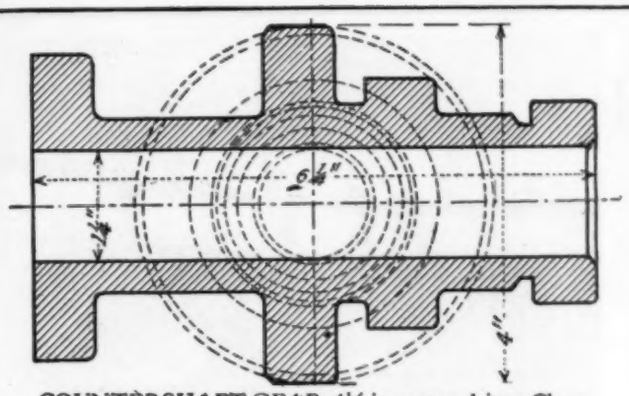
CLUSTER GEAR. 3-in. double-range motor-driven Cleveland Material, cold-rolled steel. Operations: 1—Feed stock and gage to length. 2—Center drill and rough trepan 3—Drill half way through and finish trepan 4—Form and finish drill clear through 5—Ream 6—Cut off Time, 6 min. each



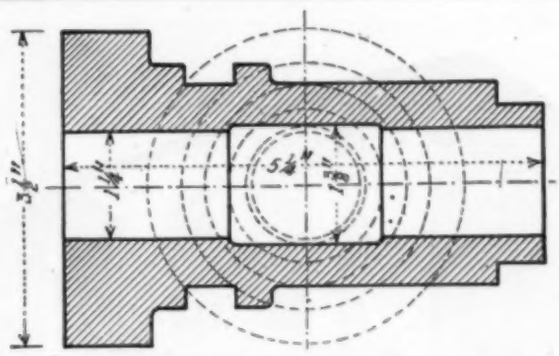
BALL-THRUST RACE. 6¼-in motor-driven Cleveland. Make five sizes from 0 90 to 1 10 carbon tool-steel. Operations: 1—Feed stock and gage to length. 2—Drill, form and rough turn o.d. and ball groove 3—Bore and chamfer hole at one end only and finish ball groove 4—Ream 5—Cut off. Time, 2⅝-in diameter, 7 min each. 4⅛-in. diameter, 8 min each. 5-in. diameter, 9 min each. 5⅛-in diameter, 10 min each. 6½-in. diameter, 12 min each.



CLUTCH-GEAR BLANK 6¼-in. motor-driven Cleveland. Material, S.A.E. No. 3450 smooth-drawn steel. Operations: 1—Feed stock and gage to length 2—Rough turn 3—Finish turn. 4—Form. 5—Cut off Time, 24 min each



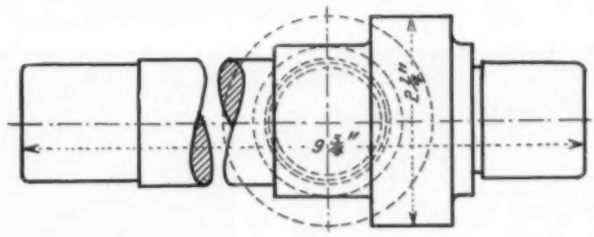
COUNTERSHAFT GEAR. 4½-in. motor-driven Cleveland. Material, S.A.E. No. 3450 smooth-drawn steel. Operations: 1—Feed stock and gage to length. 2—Drill half way through and rough turn. 3—Drill clear through and rough and finish turn. 4—Bore and form. 5—Ream. 6—Cut off. Time, 20 min. each.



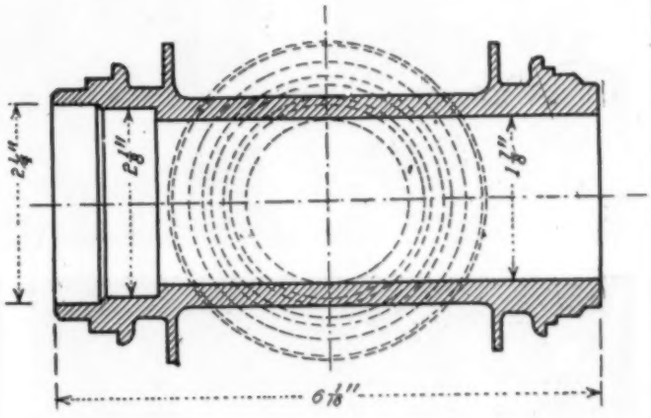
GEAR BLANK. 4½-in. motor-driven Cleveland. Material, S.A.E. No. 1045 smooth-drawn steel. Operations: 1—Feed stock and gage to length. 2—Drill half way through and rough turn. 3—Drill clear through and finish turn. 4—Recess. 5—Ream and form. 6—Cut off. 16 min. each.

What Modern Machine Tools Are Doing

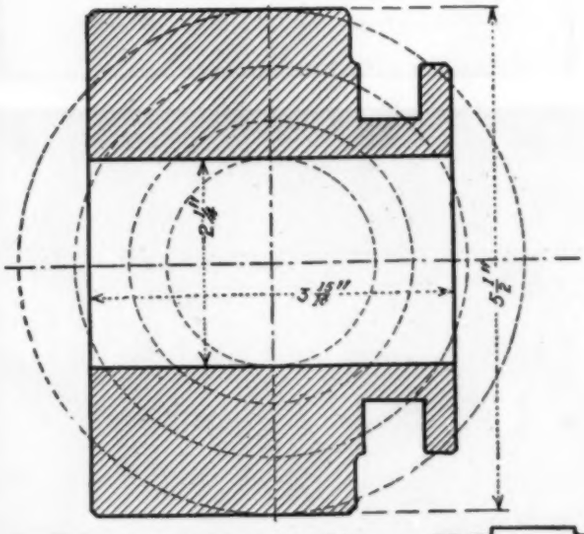
Cleveland Automatics



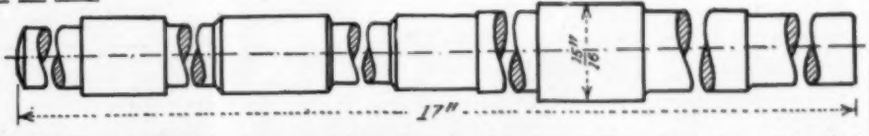
COUNTERSHAFT. 3-in. double-range, motor-driven Cleveland. Material, S.A.E. No. 1020 cold-rolled steel. Operations: 1—Feed stock and gage to length. 2—Rough turn. 3—Finish turn. 4—Form. 5—Cut off. Time, 11 min. each.



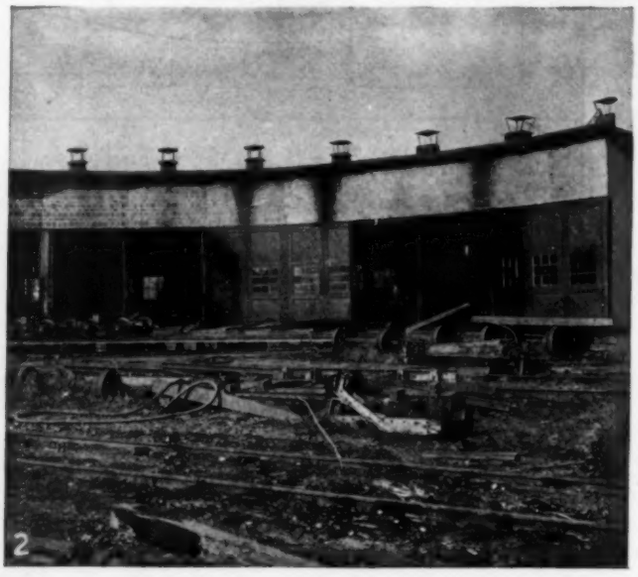
MOTORCYCLE HUB. 4½-in. motor-driven Cleveland. Material, 0.20 carbon cold-rolled steel. Operations: 1—Feed stock and gage to length. 2—Drill 2⅛-in. diameter hole. 3—Drill small hole and form. 4—Counterbore 2⅛- and 2¼-in. diameter holes. 5—Ream small hole. 6—Cut off. Time, 11½ mn. each.

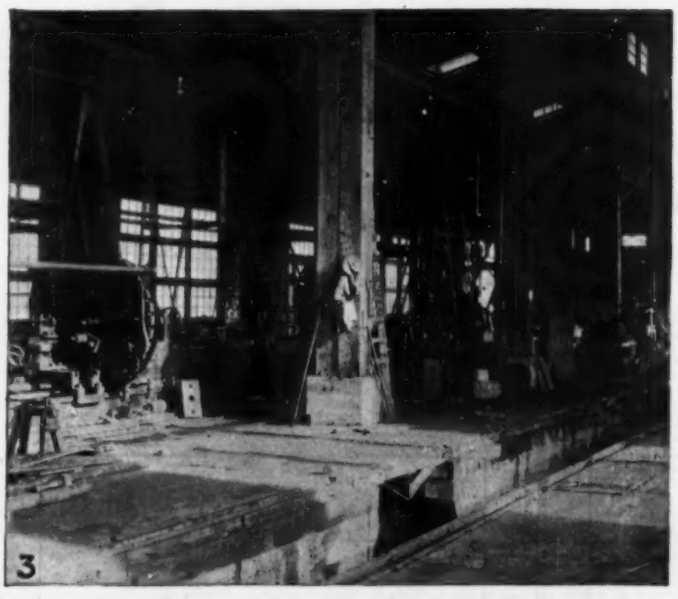


SHIFTER-GEAR BLANK. 6¼-in. motor-driven Cleveland. Material, S.A.E. No. 3450 rough-turned steel. Operations: 1—Feed stock and gage to length. 2—Drill and rough turn. 3—Bore, finish turn and form. 4—Ream. 5—Cut off. 21 min. each.



SHAFT. 2-in. B-18 feed, motor-driven Cleveland shaft-machine. Material, cold-rolled steel. Operations: 1—Feed stock and gage to length. 2—Turn right and left hand shoulders, turn undercuts and break down for cut-off. Time, 4 min. each.





Where Logging Locomotives Are Kept in Trim

Peninsular R.R. shop at Shelton, Wash.

Fig. 1—General machine and repair shop
Fig. 2—Part of the round house
Fig. 3—Pit track and wheel lathes
Fig. 4—Where trucks are repaired
Fig. 5—Planer, radial and small lathes

Methods of Packing for Export

By C. J. Priebe

A system thoroughly tested by experience—
Standard specifications for all parts of the work
—The safety of the product must be assured

BETTER not ship a product abroad than have it arrive in a damaged condition. Any serious injury will be quite expensive to you as the shipper, and will certainly not be a desirable advertisement for you. This is the thought that governs the export packing done by the Worthington Pump & Machinery Corp., a concern that does a large export business in pumps, engines, power and mining machinery, and the like. The lessons learned by both this concern and other exporters have been applied to good advantage, and the system employed when packing for shipment might well be considered by other exporters.

Fig. 1—Machinery being lifted into the hold of a ship by the crane of a lighter

Machines, of all sizes from small pumps to large ones weighing many tons, must be exported, as well as small packages of repair parts. Because of the fact that the concern has eight plants building its products, it was necessary to have some definite guide that would govern the work of all of them and give uniform quality in the method of packing for shipment. The instructions that have been drawn up for the work are such as to care for all phases of it, and they are the very backbone of the system.

The work of standardizing the methods is based on a long study of the subject. The management does not believe it possible for anyone to lay down intelligent specifications for containers for export shipment unless he has actually seen the conditions under which the packing must function. Experts have been sent abroad to the destinations of the cases, to observe the condition in which they arrived. Furthermore, the method of handling cases both when being shipped from this country and when arriving in other countries has been noted. Considerable information has been accumulated in this way, as well as by employing the ordinary sources and by co-operating with other manufacturers and exporters.

Naturally, a container not designed with a knowledge of the conditions that it will encounter will not be able to withstand much of the rough treatment that usually accompanies an ocean voyage. Cases must be handled in the same manner as the large casting shown in Fig. 1

Fig. 2—How Worthington pumps are packed. *Fig. 3—A group of small cases ready for shipment*

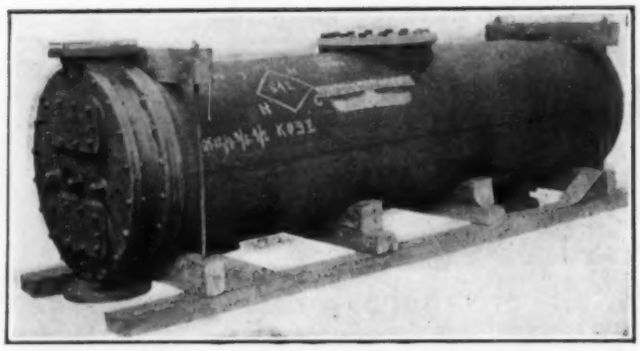


Fig. 4—Products such as this do not require boxing

being lifted from a barge by a crane on a lighter, to be deposited in the hold of the ship from which the view is obtained. Large cases are handled by slings, and frequently receive some very heavy blows when being lowered. Smaller boxes and cases such as seen at the left are usually handled a number at a time in a net. After the hold of a ship has been filled, the containers at the bottom of the pile may carry an excessive weight. Sad then is the fate of the machine whose case is too weak to carry the load.

To see the dispatch with which cases for standard pumps and machines are turned out is educational, to say the least. The secret of it lies in standardization of parts and systematizing of the work. The instructions enable the workers to go about each job in a way that will produce a substantial container. In Fig. 2 can be seen a view taken in the shipping department of the Worthington Works at Harrison, N. J. The thoroughness with which the pumps are protected from injury by bracing can be seen from the cases that have been stood up for inspection.

In Fig. 3 some small cases ready for shipment can be observed at close range. Several things are noticeable, one of them being the clear marking put upon each case. A glance will show that the products are intended for destinations in practically all parts of the globe. The strapping around the cases should be noticed; and one would judge, even from appearance alone, that the cases will stand considerable abuse before the product itself is injured. It is intended that the containers should take all stresses that come from outside forces and should transmit none of them to the machine.

Small parts and machines of ordinary size are completely inclosed, so that nothing can be lost from the package, nor can access be obtained to the inside without destroying the case. Even large machines should be totally inclosed. When it comes to products such as shown in Fig. 4, it is desirable not to attempt complete encasing. The theory is that the product itself is strong enough to withstand injury, no matter in what position it is placed, or what is placed upon it, within reasonable limits. The question of handling is the major consideration. It is very much easier for the man doing this handling if he can see what the product is that is in his care. It would be quite easy for him to sling a rope around a condenser, although he would have considerable difficulty if it were completely boxed.

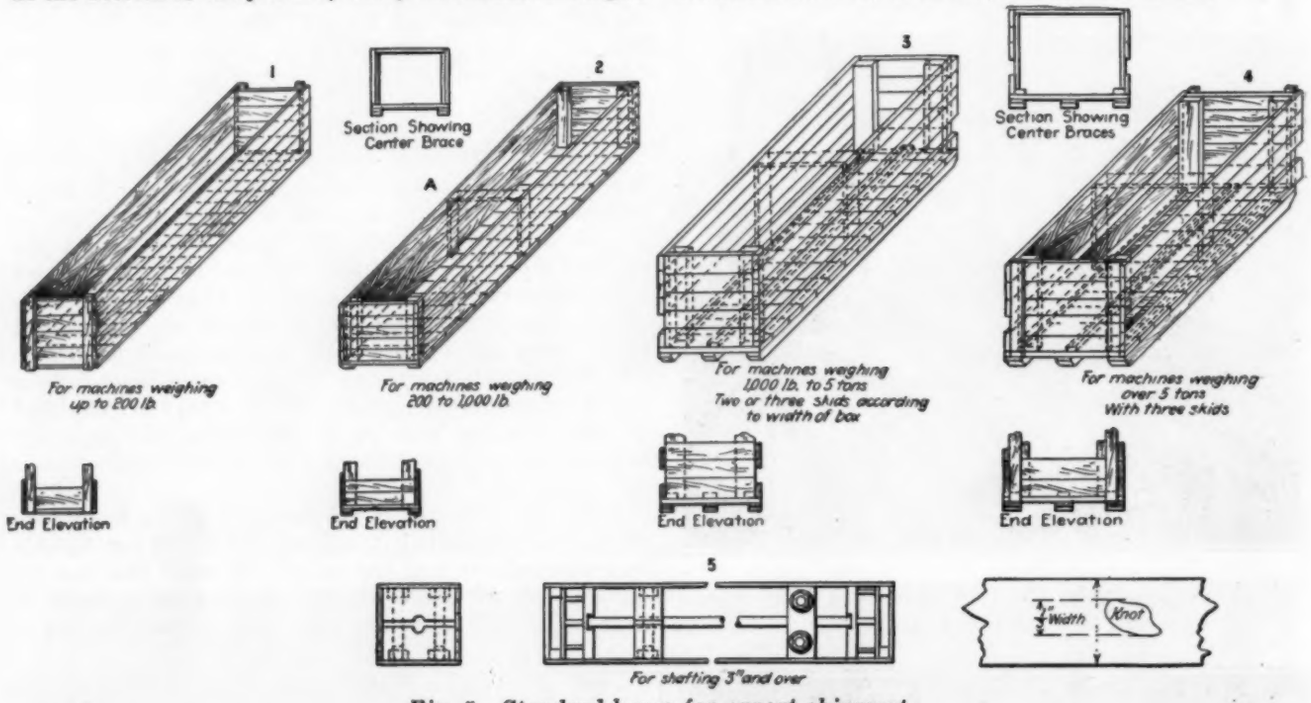


Fig. 5—Standard boxes for export shipment

In this particular instance both economy and the safety of the work point in the same direction, so that a container can be dispensed with. If, however, it should be felt that the product was too fragile to withstand handling by means of a sling directly around it, then of course the container would be necessary, even if the expense were quite high.

We now come to the means by which standardization of the containers is obtained. The instructions for the packers are all given in a set of standard specifications that have been drawn up to cover all phases of the work. Rather than attempt to rehash them and give them in part, it seems best to reproduce them just as they are issued to the packer in the plant.

It will be noted that not only the sizes of the pieces, but the kind and quality of the lumber are stated. There are several styles of box, as shown in Fig. 5, that

are suitable for the work and that have been adopted as standards. Nailing, strapping and marking, as well as protecting the machined surfaces against rust, are all given consideration. Those who do export packing would certainly be rewarded for investigating these specifications, partly because of the care with which the latter have been prepared, but also because of the fact that they have been tried in actual practice and have been found suitable for a great variety of work.

Standardization of Specifications for Export Boxing

Worthington Pump & Machinery Corporation

1. Kind of Lumber

(a.) Lumber for all boxes should be either spruce, North Carolina yellow pine or birch, the choice to depend upon the price. When the prices of these lumbers are approximately the same, spruce is preferred.

(b.) All boxes must be well manufactured from lumber which is sound (free from decay and dote) and well seasoned. Lumber must be free from knot holes and from loose or rotten knots greater than 1 in. in diameter. Knots whose diameters exceed one-third the width of the board, measured as at *B* in Fig. 5, will not be permitted and no knots will be permitted which interfere with the proper nailing of the box.

For these specifications, well-seasoned air-dried lumber should be used. Trash lumber must not be used under any circumstances.

2. Thickness of Lumber

For boxes containing materials weighing up to 1,000 lb. net, use 1-in. boards for all side pieces, ends, tops and bottoms.

For boxes containing materials weighing over 1,000 lb., use 1¼-in. boards for all side pieces, ends, tops and bottoms.

Net Weight Up to 200 lb.	Size of Skids	Size of Corner Pieces Outside Cleats
200 to 600 lb.	1¼ x 3 in.	2 x 2 in. Corner Pieces
600 to 1,000 lb.	1¼ x 4 in.	2 x 4 in. " "
1,000 to 2,000 lb.	2 x 6 in.	2 x 4 in. " "
2,000 to 8,000 lb.	3 x 6 in.	2 x 4 in. " "
8,000 to 10,000 lb.	4 x 6 in.	4 x 6 in. " "
10,000 to 16,000 lb.	4 x 6 in.	4 x 6 in. " "
16,000 to 24,000 lb.	6 x 6 in.	4 x 6 in. " "

3. Width of Lumber

No piece less than 2¼ in. face width shall be used in any part of the box except for cleats, unless any dimension is under this size.

Any end, side, top or bottom 6 in. or less in width should be one piece of stock.

4. Styles of Boxes

(a.) Boxes containing materials weighing up to 200 lb. net should be constructed as per Style 1 shown on the attached blueprint (see Fig. 5), without skids.

(b.) Boxes containing materials weighing from 200 to 1,000 lb. net should be constructed as per Style 2.

(c.) Boxes containing materials weighing 1,000 lb. to 5 tons should be constructed as per Style 3, with three skids.

(d.) Boxes containing materials weighing over 5 tons should be constructed as per Style 4.

Boxes for shafting 3 in. and over to be constructed as per Style 5.

(e.) No box shall be used that is not constructed with either inside corner pieces or outside cleats.

5. Packing

Repair Parts: In packing repair parts, especially such materials as piston rods and other small parts, care should be taken to place cross pieces at intervals these cross pieces to be nailed through the sides of the cases to relieve the strain of the entire weight of the contents coming either on the top or the bottom of the case according to the position in which it may be placed. In packing small parts all slack must be taken up by filling all unoccupied spaces with thoroughly dried excelsior or saw-dust.

All machines weighing 1,000 lb. or over must be placed and properly fastened to skid before being set in the box. Each machine should be properly fastened to its skids by round carriage bolts, the heads of the bolts to be countersunk in the skid flush with the face of skid. Lag screws must not be used.

Under no circumstances may a machine be rigidly fastened directly to the bottom of its box. Every machine must be bolted to skids or, as in the case of machines weighing under 1,000 lb., must be placed on wooden supports which are in turn nailed to the bottom of the box.

A machine after being placed in its box must be so braced that there may be no danger of movement in any direction after the box is closed. The inside bracing of the box should be so placed as to prevent the crushing of the box when handled by slings.

All parts should be snugly tight in the case, as the least bit of movement may result in serious damage. Pieces of irregular form should be braced at every curve and angle, the box itself being reinforced inside and out to prevent its going to pieces if suddenly dropped.

Unoccupied space in the interior of packing boxes must be thoroughly braced. This is not merely a question of bracing the contents of the case from shifting about within; but the manner of loading on board ships must be remembered, as weak spaces in the packing cases are likely to give way when crushed by other and heavier pieces or when falling upon their ends, if not properly braced from within.

Crosspieces of suitable size must be placed under and on top of machine and fitted up tight to support the weight of the contents if case is slung at an angle or endwise.

6. Surfacing

No batterns should be placed on the outside of the box. The outside surface of the box must be smooth.

At least two boards on the side of each box must be surfaced, to be used for the necessary size number data.

At least two boards of the cover to be surfaced for shipping marks.

7. Nails

All nails must be standard, cement coated, box nails. On all cases up to 200 lb. net, 8 d. nails should be used. On all cases 200 to 2,000 lb. net, 10 d. nails should be used. On all cases above 2,000 lb., 12 d. nails should be used for bottoms, covers and corner posts. For heavy skids and corner posts, larger nails are used as may be found necessary.

8. Strapping

All boxes must be strap-ironed, strapping shall be cold-rolled, unannealed steel, ⅝ in. wide for boxes up to 1,000 lb. and 1 in. wide for boxes over 1,000 lb. Thickness, 0.015 in. It shall have tensile strength of not less than 800 lb. It should be treated to prevent rust and should be of such character as to prevent injury when being bent or nailed. Strapping should be smooth and not beaded or corrugated. When being placed on the box, it should be drawn tight by mechanical means in order to have the maximum tension.

9. Covering of Machines

All finished exposed surfaces must be thoroughly protected by a heavy rust-preventing coating. The Worthington and Blake Shops have successfully used a slushing compound known as "Blue Lacquer." This compound should be used on all exposed finished parts.

All finished working parts that are enclosed, such as cylinder bores, valves, valve seats, pistons, etc., should be thoroughly slushed with a heavy grease.

Uncovered oil holes and top holes must be filled with pine plugs, driven in to exclude dirt. All electrical machinery should be carefully and adequately covered with a good weatherproof fabric, so as to keep out all moisture, before being placed in the box. The box containing this electrical equipment should also be lined with weather-proof fabric. After the box is nailed up, the top side of the box should be covered with weather-proof fabric.

10. Marking

Each box should be carefully and legibly marked. It is recommended that every box be marked by stencil.

Each box should be weighed individually and the correct net and gross weights should be plainly marked on each

box. This is important. Average weights must not be used.

The marking ink should flow easily, not dry too quickly and should have sufficient body to make the marked characters stand out clearly.

NOTE: Our chemists have in hand the production of such an ink. Meanwhile it is recommended that we use the marking ink manufactured by the General Electric Co., Schenectady.

11. Boxing for West Coast of South America

All boxes for the West Coast of South America must be made of lumber having a minimum thickness of 1½ inches.

Remarks

These specifications cover only the general underlying principles of export packing based on the experience of many of the leading machinery builders of the country. It is recognized that details will vary in the boxing of different types of equipment, and it must remain with the individual packer to use such judgment on details as to insure a thoroughly strong and safe package. The ultimate test on every package should be:

(1.)—Is the machine well packed in the box?

(2.)—Is the box strong enough?

When in doubt, play safe by making the box stronger.

How Not to Learn

BY ENTROPY

Every live man has a longing to know something that he does not know now. It may be golf or Mah-Jong or it may be something about differential indexing, but that something represents to him the unattainable without outside help.

If he is blessed with a surplus of income he hires a tutor and learns by dint of long practice and imitation, but if he is after differential indexing or any other mechanical art, the chances are that his income is not elastic enough for the purpose, so he goes up to the public library and asks for a book. The chances are against him because the young lady at the desk is considering having her hair bobbed and is taking expert advice herself on that subject, and then again she has no idea whether this kind of a differential goes on a Rolls-Royce or a freight rate. So he goes to the card index, and finally discovers that he must look up "Milling Machine" first and then read until he finds about the thing he is after. He does so, frequently putting in a very considerable amount of time.

TOO SIMPLE OR TOO VAGUE

Then he discovers one of two things, either the book is so elementary that it tells him nothing he did not know before, or it is so advanced and assumes so much knowledge of what has gone before that he must read the whole volume on machine shop practice before he can discover what the symbols stand for.

This is not overdrawn. There are plenty of good books on machine shop practice, but very few that emulate the sectional book case in that you can buy one chapter at a time and find it nicely dovetailing into some other chapter that you may buy next year or the year after. The correspondence schools do not help much. They tell you the way to find out about differential indexing is to buy a complete course of machine shop practice, ten dollars down and ten a month thereafter and begin with drilling and work through till you reach milling, but by that time the job of differential indexing has been spoiled or given to someone else to do.

Famous Machinists of History

BY H. H. MANCHESTER

Matthew Boulton (1728-1809)

Matthew Boulton was born in 1728, in Birmingham, Eng., where his father was a silver stamper and a maker of metal buttons.

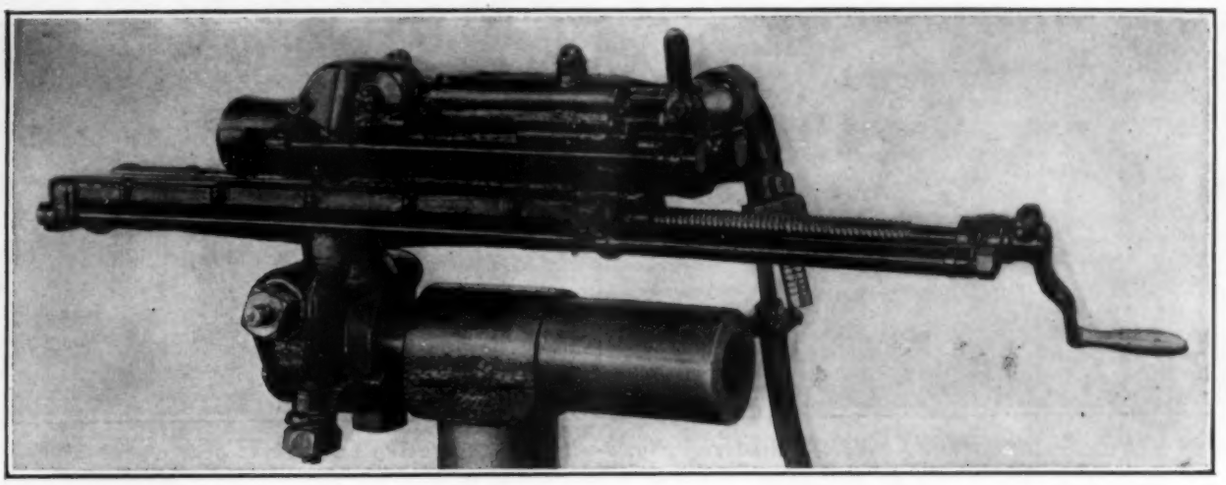
He was educated at a private academy, but left while still a boy to enter his father's factory. He took great interest in this and learned the whole trade from the ground up. When only seventeen he introduced improvements in the method of manufacturing metal buttons and watch chains. Not long afterwards he invented steel buckles and a process for producing them economically. At first these were exported to France and imported again to England as the latest product of French fashions. By the time Matthew was twenty-one his father had so much confidence in him that he took him into partnership, and the two handled the business together for the next ten years, when the father died.

In 1760 Boulton married Anne Robinson after overcoming the objections from her parents. She brought him a large dowry, and Boulton felt enabled to build a new factory costing $100,000, at Soho, two miles north of Birmingham. Here he manufactured metal buttons, buckles, clasps, watch chains, and filigree work. Later he added copies of artistic candlesticks and other metal objects, and more complicated products such as astronomical clocks.

The sales, which had amounted to about $35,000 in 1763, rose to about $150,000 four years later. The factory had two large waterwheels which drove machinery for rolling, grinding, and polishing, and for turning all sorts of lathes.

Boulton became interested in Watt's steam engine, and in 1772 took over Roebuck's interest in it, in payment of a debt for 1,200 pounds. Three years later he formed a partnership with Watt, and from that time was the driving force behind the introduction and exploitation of the engine. It is not too much to say that Watt would have failed in a dozen places if he had not been sustained by the promoting, selling, and general business ability of his partner.

In 1788, after the steam engine was a practical commercial success, Boulton acting upon his former experience in stamping, invented a coining machine driven by steam. With this he produced the coinage for several countries, and in 1797 put out a new copper coinage for Great Britain. He retired in 1800, and died nine years later.



Manufacturing the Waugh Rock Drill

By J. C. Briggs
Engineer, Denver Rock Drill Mfg. Co.

Close machine work necessary—Special tools and fixtures for high production—Drilling holes outward from cylinder bore—Grinding and broaching operations

THE business of mining, as with other production businesses, owes a great deal of its success of late years to the development of automatic, high-speed machinery. The old-time pick has given way to the rock drill, which is driven by compressed air and operates with a degree of precision and speed that is only possible because of the care and accuracy with which the parts are machined. Some of the operations in the production of rock drill parts in the plant of the Denver Rock Drill Mfg. Co. are described herewith.

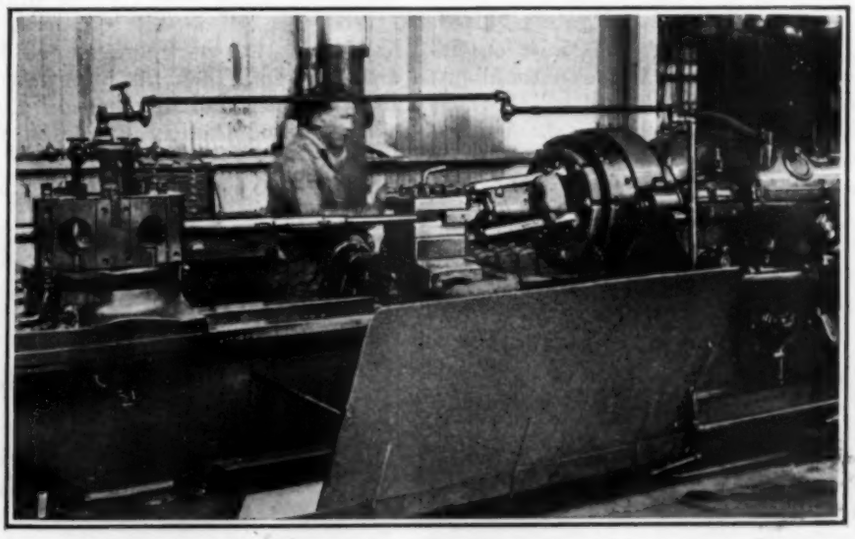
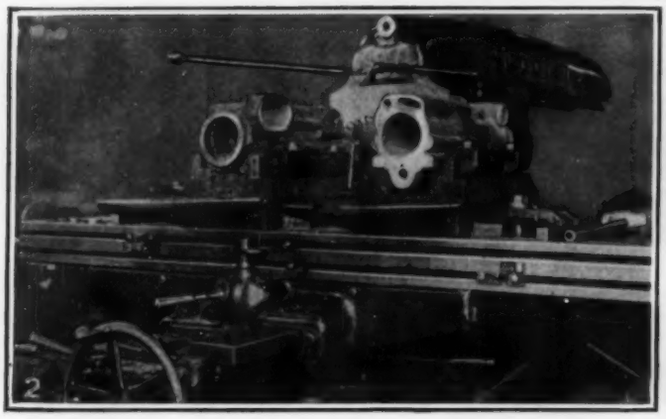


Fig. 1—Boring a rock drill cylinder

The part that forms the base of the machine is the cast steel cylinder, one of which is shown in the Libby lathe, Fig. 1, undergoing boring. The hole is first rough-bored with a Davis boring bar, taking a $\frac{7}{32}$-in. cut with a $\frac{1}{32}$-in. feed, then it is finished with a Davis boring bar that takes a $\frac{3}{32}$-in. cut with a $\frac{1}{16}$-in. feed while the piece revolves at a speed of 46 r.p.m. The hole finishes at 3.062 in. with a 0.005 in. limit. The piece is then faced and a recess is cut, plug gages being used to gage the hole and an indicator being used to determine the depth and diameter of the recess. A piece can be finished on this operation in 29 min. The efficiency of the modern machine tool is apparent when it is known that the best time on this operation on a former machine—a lathe of the older type—was 54 minutes.

A cylinder of the same type but of a different model is shown on the Cincinnati No. 4 milling machine, Fig. 2, where the ends are milled off. A double fixture is used so that one piece can be changed while the other is in process. Each piece is clamped in a slide that is gibbed to a base upon which it rests, binding levers being provided to lock the slide so as to form a rigid fixture. After one end of a piece has been machined and while the other piece is in process, the slide is pulled out to clear the ways, then is turned around on the platform provided on the end of the base for that purpose and is slid back into position



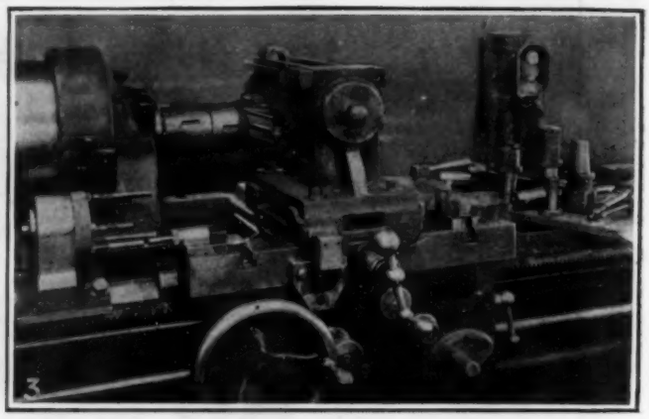


Fig. 2—Face-milling ends of cylinders. Fig. 3—Boring and facing air-turbine gear chambers

for milling the opposite end. A swivel in the bottom of the slide rides in a slot in the base just long enough to prevent the slide from sliding out too far. The piece rests on four points on the slide, one point being adjustable with a set screw so that the piece can be clamped without springing. The stock removed in one cut is ¼ in. thick and the work is held to a limit of ⅛ in. A piece is finished complete in 17 minutes.

Machining Gear Chamber

The chamber that holds the air-turbine gears is faced off and bored for the gears, and holes for the shaft roller bearings are drilled and reamed in the Walcott lathe shown in Fig. 3. The piece is clamped in a fixture attached to the carriage of the machine and the tools are held in the machine spindle, each tool being attached to a stub arbor on which is a flange that is flat on either side, to slip through a corresponding aperture in the adapter. One quarter turn of the sleeve that screws onto the nose of the adapter locks the tool firmly in position. This locking device is similar to the bayonet lock, and although a trifle slower to operate, is much more dependable and accurate—a feature that is most desirable on account of the close limits required. Limits of 0.002 in. on the diameter, 0.0025 in. on the depth of the gear casings and 0.00025 in. on the diameter of the shaft-bearing holes are allowed, all of which are determined with the aid of plug gages. A piece is finished on this operation in 1 hr. 40 minutes.

The illustration Fig. 4 shows two of the Lodge and Shipley lathes used for turning the forged piston hammers (which can be seen in the left foreground of the illustration) rotating sleeves, chuck drivers and other parts that must be accurately turned in relation to fixed centers or broached holes of various shapes.

Drilling Air-Port Holes

A number of air port holes are drilled longitudinally into the end of an air drill cylinder, and each port must be opened to the central bore of the cylinder. This was formerly done by drilling all the way through from the outside of the cylinder, then tapping and plugging the holes from the outside. As the plugs, however, were liable to jar loose with the vibration of the machine when in action, the machine shown in Fig. 5 was developed for this operation. A short ⅛-in. drill *A* is locked in a chuck carried in a sprocket in the end of, and at right angles to, a horizontal arm, the chuck-sprocket being driven by a roller chain from a sprocket that is integral with a pulley at the rear of the machine, Fig. 6. The piece is clamped to a sliding fixture, as shown, and is then moved in to a stop, of which there are four for the different hole locations. A cross-feed screw, operated by a hand lever, provides for feeding the work against the drill. Four holes are drilled in line, then the piece is turned half way over and the other four are drilled. Kerosene is used for a lubricant and the eight holes are drilled in 10 min. complete.

The use of a band saw for production work is shown

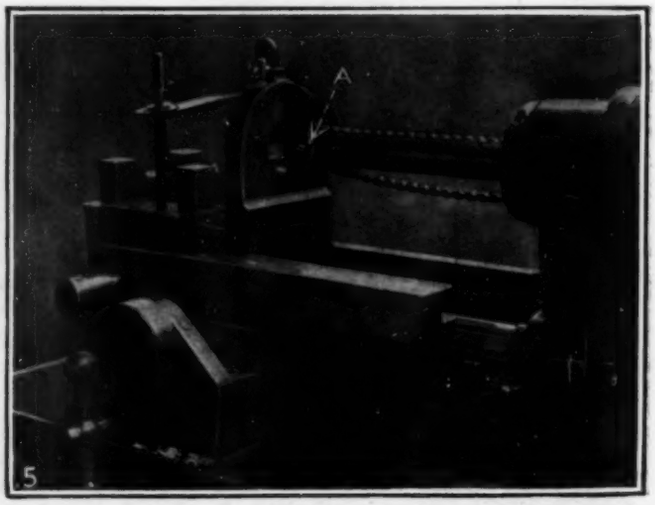
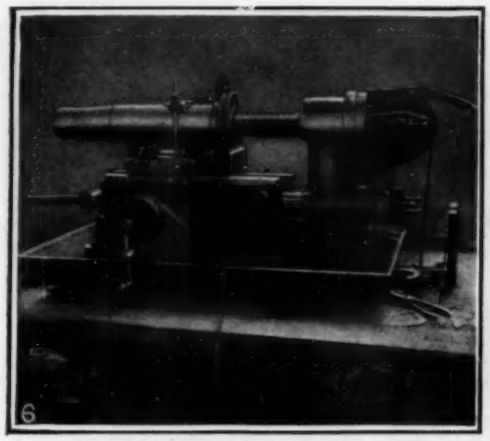
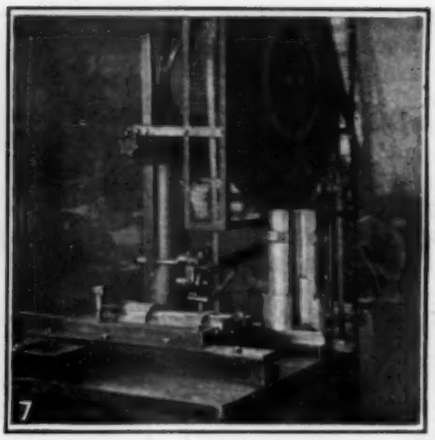


Fig. 4—Speed and accuracy is the rule here. Fig. 5—Drilling holes from cylinder bore to air-ports





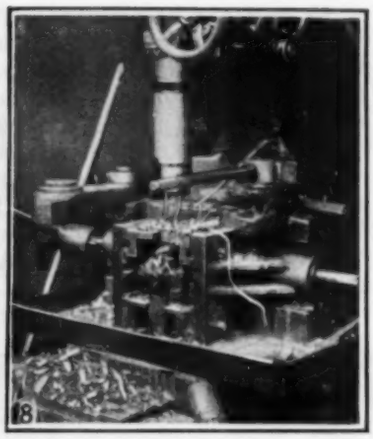


Fig. 6—Piece shown in operation. Fig. 7—The band saw as a production machine. Fig. 8—Saving time on rough drilling

in Fig. 7, where a clamping die for a drill-sharpening machine is being split into halves, two of which are shown standing on the table of the machine. The piece is of high carbon steel and is clamped by end-clamps in a V-block that locates it centrally. Approximately 40 min. is required to split a sleeve, which time is not lost by the operator as he runs a lathe while the band saw is in operation. A light milling cut is taken over the surface of each piece after it leaves the saw, from 0.015 in. to 0.040 in. being removed, which imparts a smooth finish and makes all pieces interchangeable.

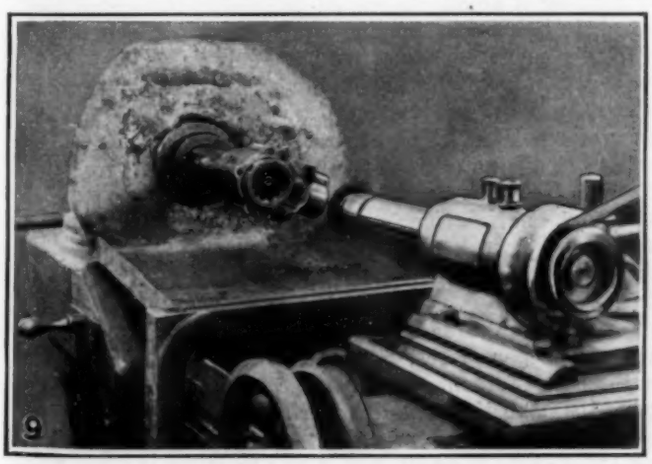
Some types of cylinders are rough drilled in the Colburn drill press shown in Fig. 8 preparatory to going to the Potter and Johnston turret lathe to be finished, as this operation can be done faster in the drill press than in the turret lathe. The feature of the job is the chuck, which is horizontal and is made with two jaws—a type of construction that helps to keep the chips out of the screw, allows a maximum of working space and is easy to operate. The bushing for the drill is carried in a hinged arm, indicated by the arrow, provision being made to lock the arm in position until the drill is well into the piece, when the arm is swung back out of the way as shown.

The job of grinding the wall of the opening in the end of a valve chest is shown set up in Fig. 9. The machine is a Heald internal grinder in which the original work spindle has been replaced by a solid spindle extending some distance beyond its bearings and ground taper from the bearings out to the end. The work is held on an expansion bushing that fits the taper on the end of the work spindle as shown in Fig. 10. This device is used where it is necessary that two holes be ground concentric with each other, at different settings of the piece. The diameter of the opening is held to a limit of 0.0005 in. and is gaged with the plug gage shown lying on the table of the machine.

Grinding Splines in Piston Hammer

The two splines in the opposite sides of the piston hammer are ground in the Rivett grinder shown in Fig. 11, in which the piece is held by a chucking collar at one end and the tail-stock center at the other. The positions of the splines are located before grinding by means of a locating point attached to the angle plate *A*. After the first spline has been ground, the plug *B* is withdrawn from a locating hole in one side of the chuck and the chuck is revolved 180 deg., at which point another hole for the plug is located. The wheel is ¾x2 in. and runs at a speed of 5,000 ft. per min. There is from 0.005 in. to 0.008 in. of stock on each side of each spline to come off, the dimensions being held to a limit of 0.005 in. The two slots are ground complete in approximately 7½ minutes.

A "home-made" hydraulic broaching machine with an air return is illustrated in Fig. 12. The machine has an 8-in. oil cylinder and the pump cylinders are 1 in. in diameter, the pump operating on a two-stroke cycle with a 1½-in. stroke. With this mechanism a pressure



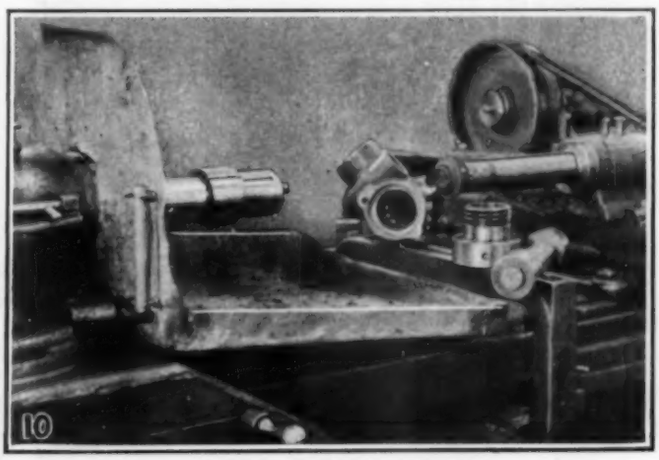


Fig. 9—Second grinding operation on valve chest. Fig. 10—Expansion bushing for holding work

of 25 tons can be obtained. The job in operation is that of broaching a hole in a chuck for a stoping machine, for which 13 broaches are used to make a square hole out of a round one. The broaches are arranged in sequence on a circular rack, shown at the right of the machine, so that the operator can turn the rack as each tool is used. Compound is used as a lubricant and the hole is held to a limit of 0.005 in. As a matter of fact, the hole usually finishes at within 0.002 in. of the drawing size. A square plug is used to gage the hole.

An interesting and time-saving method of balancing

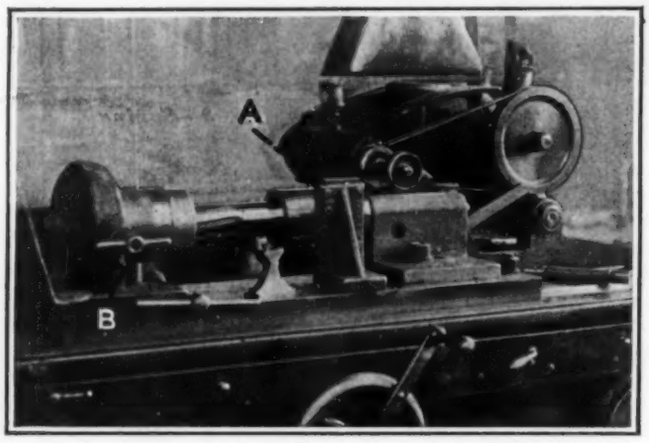


Fig. 11—Grinding splines in piston hammer

a grinding wheel is shown in Fig. 13. The wheel mounting is the standard Norton product with the exception of the three pieces *A* shown in the bore of the flange. The pieces are sections of what was originally turned up as a solid ring. A taper was turned on the periphery of the ring and a corresponding taper bored in the flange, then each section of the ring, after cutting, was drilled and tapped for a set screw as

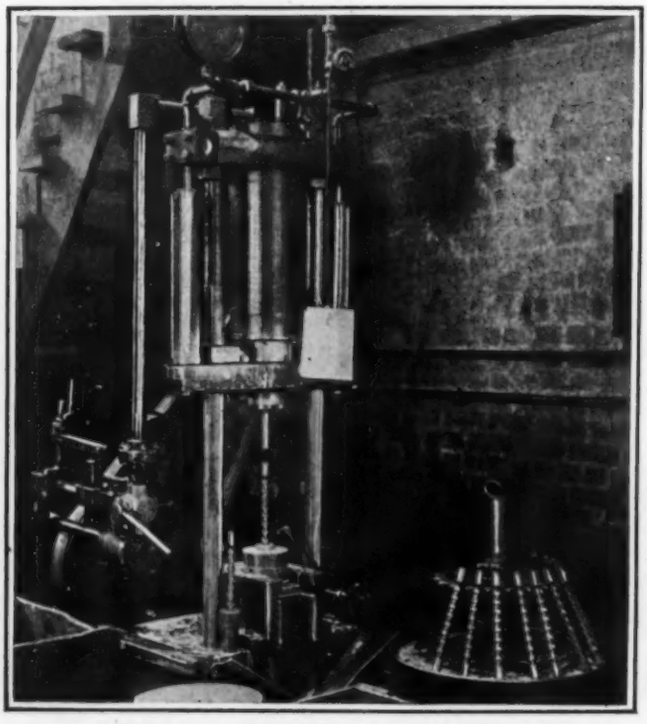


Fig. 12—"Home-made" hydraulic broaching machine

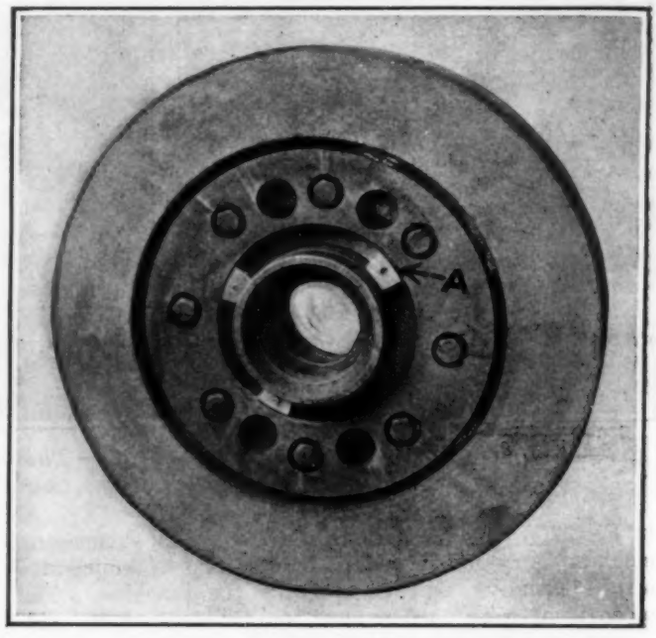


Fig. 13—Balancing a grinding wheel quickly

shown. Screwing the set screw in forces the section up against the taper in the flange and holds it tightly in place, this method making it possible to adjust and lock the sections at any desired location around the bore of the flange. When balancing the wheel, the sections are moved about and locked in the necessary positions to balance and are then left there until a new wheel is put on the flange. Eight sections are usually used in balancing a wheel. With this method no weights need be used and no holes are drilled, the job is very simple and much time is saved.

Inducing Better Care for Work Tickets

By Frank V. Faulhaber

In some machine shops a good deal of time is often lost because of mislaid work-tickets. If a work-ticket cannot be found when wanted it often sets back several men in the department, besides being a burden on patience. Then, too, it increases the overhead to bring out duplicates, which all could have been averted by a little extra care. Moreover, one large plant in Brooklyn, N. Y., has solved the problem for all time, simply by placing a small charge of ten cents on every lost ticket, to be paid by the employee last responsible.

Here's how it operates now. When an employee accepts work from the preceding operator he sees to it that he receives the work-ticket, else he would be held accountable later. The dictum in the shop now seems to be: "Take no work without its ticket," which naturally inspires care on the part of each man. The foreman says it also compels greater regard for the importance of the work-ticket, since some men are prone to go about their operations taking things too much for granted.

Now tickets cannot be found on the floor—they are in their proper places. The fact that the men all take better care of them ensures their becoming less soiled, torn, the directions and remarks thereon being more decipherable than formerly was the case. The penalty for lost tickets is small, but it has brought about a big improvement.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for

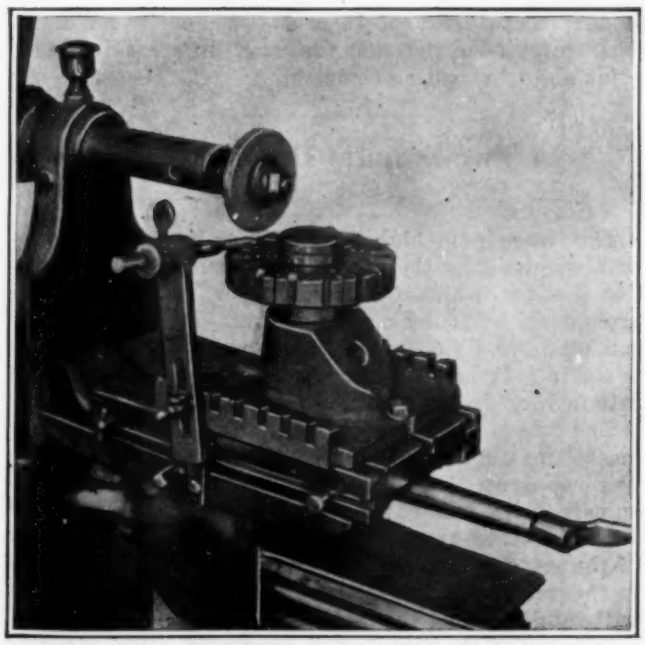
Non-Adjustable Fixture for Sharpening Milling Cutters

By Donald A. Hampson

There is illustrated herewith a sharpening fixture that is being used with marked success in connection with a single style of cutter for a battery of fifteen milling machines. Each machine has an equipment of either two end-mills or two straddle-mills, besides which there are two sets of spare cutters for the battery. Inserted-tooth cutters are used. The corners of the teeth are beveled to 45 deg. to prevent them from chipping off the corners of the finished work and at the same time to provide a cutting face that is broad enough to make any sharpening on the periphery of the cutters unnecessary. An average of $\frac{1}{32}$-in. of material is removed from the work, all in the nature of facing cuts.

Before the construction of this fixture, much unnecessary time was spent in setting up standard "universal" fixtures and the life of the cutters between grinds was subject to the personal equation, chiefly because of difference in clearances.

When using the outfit here shown, the first move is to insert a locating pin to prevent the cutter-grinding machine from shifting at the saddle joint. The cast-iron body of the fixture is tongued to fit the table groove. As the end mills are right and left hand, and there are two sides to the straddle mills, it follows that there must be provision to shift a cutter to either side of a vertical plane passing through the spindle of the abrasive wheel, and this is taken care of by making two holes for the locating pin.



Non-Adjustable fixture for grinding cutters

The above includes all the setting up required for any of the operations, aside from the vertical adjustment to bring the cutters into contact with the wheel. Note that nothing is left to chance or whim.

A cutter is shown in position for grinding one side. The stud upon which it rotates, slips into the vertical hole of the fixture block and is fastened by a thumbscrew, that bears upon a flat on the spindle. Removal of the cutter is thereby rendered easy, and while in grinding position the cutter is held firmly between wide collars, one of which is the shoulder of the stud. The amount of pressure to hold the cutter against rotation is therefore adjustable to any desired degree.

One part of cutter grinding commonly left to the judgment of the operator, is that of clearance toward the center. It is varied, according to the workman's idea by setting an angular fixture "so many degrees off," by placing a shim under one end of the fixture, or by swinging the face of the tooth to an angle with the table movement. In this fixture the base of the casting is planed off about $\frac{1}{32}$-in. toward the inner end and thus the clearance question is settled permanently.

For sharpening the beveled corners, a hole at 45 deg. is provided, into which the holding studs slip interchangeably. The respective positions are so arranged that to shift from one to the other involves practically no vertical adjustment of the knee. This point is of considerable advantage when sharpening a single cutter or pair of cutters, for instead of entirely rebuilding the structure for the second grind, the shift to the 45-deg. hole and a shift of the index casting to another slot are all the movements necessary. There are no adjustments to make because the clearance back of the cutting edge is already set.

Along each edge of the base are notched flanges into which a square-bodied bolt may be dropped. This provides a wide range of positions for the index-finger casting—positions obtained in an instant and without recourse to a wrench. The hub of this casting stands at a slight angle, thus allowing the finger to pitch in under the tooth being sharpened. A round index-finger stem is used because it allows the finger to be turned to any angle without any of the joints common to a universal finger. In fact, one of the salient features of this fixture is the ease with which index settings may be made without sacrifice of rigidity.

In making the fixture, the parts were arranged to bring the grinding level within narrow limits. The arbor holes in the cutters having been reduced to three sizes, $\frac{3}{4}$-in., 1-in., and $1\frac{1}{4}$-in. and the studs and collars were so calculated as to settle the vertical height without effort on the part of the operator.

Rigidity, simplicity, and non-adjustability were the points considered in the design and they have resulted

in a saving of more than one-half in the time of grinding the cutters. The work has been put within the range of "operators" or "hands," something rarely attained in cutter sharpening, which usually goes to tool makers and good, all around machinists. The results obtained from the cutters have been equally gratifying.

A Home-Made Thread-Milling Attachment

By Jack Williams

The illustrations, Figs. 1 and 2, show a general view and a close-up, respectively, of an attachment designed by J. H. Rice, superintendent of the Leighton Machine Co., Manchester, N. H., to be used on any standard milling machine for the purpose of milling the small, steel worms that are a component of the Leighton knitting machine. These worms are 1⅜ in. in diameter, 1¼ in. lead, and have four full turns of thread.

A standard gear cutter of the right shape is placed on the arbor of the milling machine together with the pinion *A*, which does the driving, as shown in Fig. 1. Both the cutter and the pinion are keyed to the arbor, as it is essential that there be no relative silp. The blank to be milled goes on the end of the inclined spindle of the device, where it is held by a washer and nut.

The spindle has two bearings in the housing of the device and upon a portion of its length at the rear end is cut a ¼-in. lead, square-thread screw. The small wormwheel *B* is splined to the spindle so that the latter is positively driven by it, yet is free to advance endwise through it. A loose nut *C*, of hardened steel, encloses the thread and is held against rotation by a finger-latch *D*, which may be lifted out of engagement with the square-sectioned notches on the periphery of the nut at the will of the operator.

The pinion *A* drives the gear *E*, which is keyed to a short shaft having the worm *F* at the other end. Worm *F* drives the wormwheel *G*, likewise keyed to one shaft with worm *H*, by means of which latter the wormwheel *B* is driven. The device is entirely self-contained and, though the adjustments of the milling machine are very convenient to make the original setting, the only function of the machine is to turn the cutter and driving pinion. The angle of inclination of the spindle of the device must, of course, correspond to the angle of helix of the worm to be cut.

Starting with a blank on the spindle, the latter rotates slowly forward, driven by the gear-and-worm-reduction train at a proper cutting speed, and at the same time is advanced ¼ in. per revolution by the square thread rotating in the now stationary nut. When the worm has been cut and removed from the arbor the operator lifts the finger-latch *D* and turns the nut *C* five or six turns in the same direction that the spindle is rotating, which causes the spindle to be drawn back to its original position.

The operator then puts on another blank, feeds it forward until the work meets the revolving cutter by turning the nut with his fingers, and drops the latch into the first convenient notch of the nut.

Though the device itself is non-adjustable its principle may be applied easily to the production of any small part of this nature within reasonable range. By putting in an intermediate gear on a swinging sector between the pinion *A* and driven gear *E* and reversing the direction of one or other of the worm drives, the device can be adapted for cutting various diameters. By making the angle of inclination adjustable, it could be adapted to different helix angles, and by having a separate spindle and nut for each different lead, its adjustability would be complete.

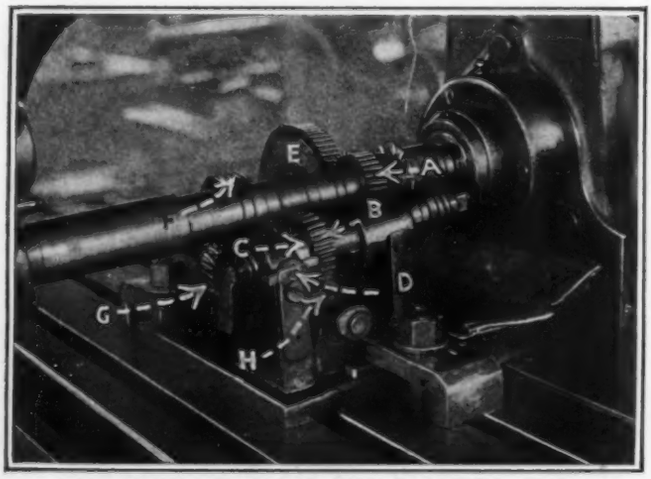


Fig. 1—Device for milling small worms

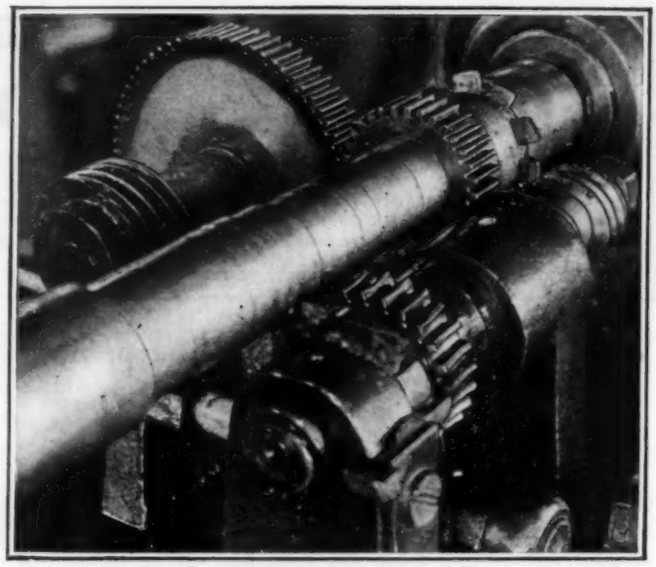


Fig. 2—Closer view of the details

A Two-Spindle Drilling Head

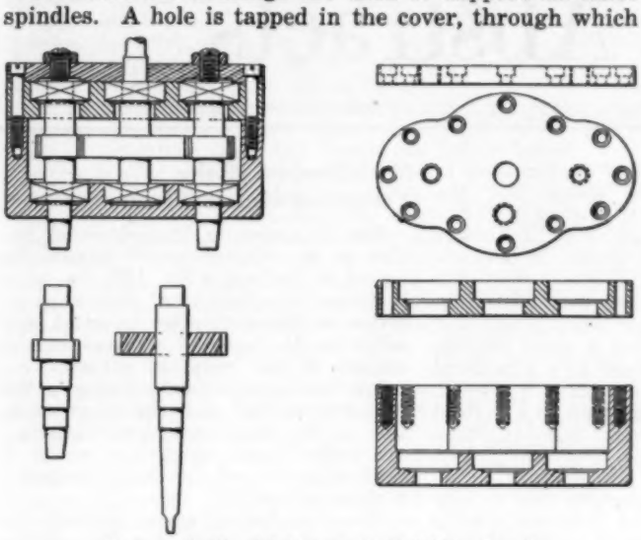
By F. C. Mason

The two-spindle, high-speed drilling head shown herewith was built by the writer to accommodate a production job for which no drill-head or two-spindle drill press could be found on the market. It is required to run at 3,000 r.p.m., and the distance between centers is 3½ in. It can be recommended as a reliable and satisfactory design.

The case is of aluminum, made in three parts. After machining the joints and assembling the parts, the case was swung up on the faceplate of a lathe and one of the spindle holes located and drilled in the cover. The cover was then removed without disturbing the setting of the remaining parts and the hole bored and recessed in the middle part. This part was then taken off, again without disturbing the setting of the main part, and the machining of the spindle hole completed. The case was

then reassembled and the sequence of operations repeated to bore and recess the remaining two spindle-holes.

Standard ball-bearings are used to support all three spindles. A hole is tapped in the cover, through which



Two-spindle high-speed drilling head

the case may be filled with grease, after which the hole may be closed by a pipe plug or a grease cup. A suitable arm, or lever, is attached to the case to rest against the column of the drill press and keep the device from rotating.

Making a Dividing Head

By Daniel Freuler

In 1899, I was employed as a creaser maker by the Phoenix Horse Shoe Co., at Joliet, Ill. The creaser is the circular die used in rolling the horse-shoe bar and is a much abused article. To make the creaser required much laborious filing and chipping. So I made a special fixture to be used on a lathe to cut away the excess metal between the points that formed the nail prints. Later the company purchased a vertical-spindle milling machine, but the cutters were quite expensive and there were frequent delays in receiving them. I figured that we could make the cutters cheaper and at the same time have them when needed, if we had a dividing head, which we decided to make.

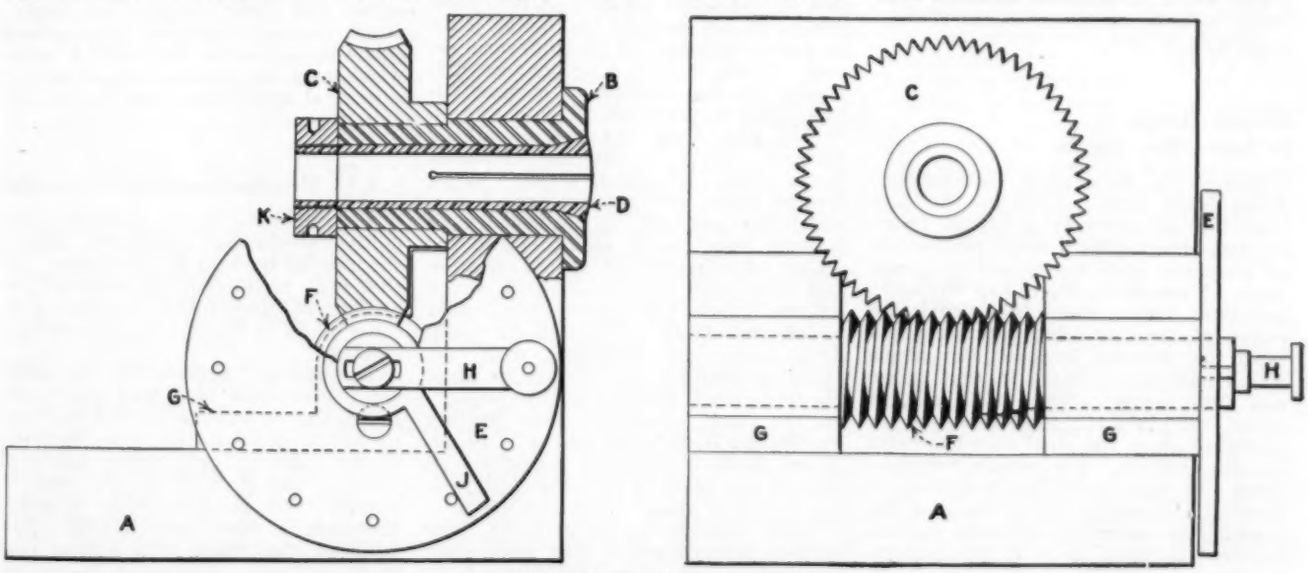
In the illustration, the base *A* was made from a broken breaker from 18-in. rolls and when machined all over, the angle plate made from it formed a rigid body. A piece of shafting from the scrap pile answered for the spindle; a piece of a broken neck from a 9-in. roll was used for both the work wheel and the index plate; another piece of scrap shaft for the worm; while a piece of an old wabbler furnished the material for the bearings of the worm shaft. Having the material the machine work was done at odd times.

One of a set of 1⅛-in. taps was used as a hob, and a little figuring determined the proper diameter for a wormwheel having 60 teeth. The worm was made to suit the wheel. The next thing was to make the index plate, the blank for which had been cut from the roll neck. The hole circle was laid out for twelve holes and drilled with a ⅜-in. drill. After the holes were drilled, a link or templet long enough to take in three holes of the circle, was clamped to the plate. Three pins were then fitted to these holes and starting with the templet at the zero hole, it was moved the distance of one hole and the pins tried in the holes to check the spacing. Only two holes were out enough to prevent the pins from entering. Starting again at zero and moving in the opposite direction, it was found that the error could be corrected by reaming the templet to receive a ⅜-in. pin and then reaming the index plate by the templet.

The collet from the milling machine was used, and drawn in by means of a nut drilled for a spanner wrench. In the accompanying drawing *A* is the body; *B* the spindle; *C* the worm wheel; *D* the collet; *E* the index plate; *F* the worm; *G* the bearings; *H* the crank; *J* the sector and *K* the spindle nut. The dividing head proved to be very serviceable, not only for making all of our own end and creaser mills, but for many repair jobs. Sometimes it pays to use up scrap in this way. I visited this plant in 1916 and the old dividing head was still doing business.

The time spent on the job was about 36 hr. and as I was getting 45 cents an hour, less than $18 covered the direct labor cost.

There are probably few conditions today where it would pay to make either the dividing head or the milling cutters, but things looked different in 1899.



Details of the dividing head

Technical Abstracts

Regrinding Practice Is Described

K. H. Lansing deals with the processes of regrinding cylinders and crankshafts. As the result of expert cylinder regrinding, gasoline and oil consumption may be reduced from 25 to even 50 per cent so that the process is well worth considering.

The majority of cylinder grinding machines embody a horizontal wheel spindle, and although some types of machines are equipped with means for wet grinding, the majority of shop operators favor dry grinding with an exhaust system for carrying away abrasive dust. Selection of wheels of the proper grit and grade is extremely important, the best practice being to use a wheel just soft enough to stand up under reasonably heavy cuts.

Carbide of silicon wheels are used for grinding cast-iron cylinders. Steel and semi-steel cylinders are finished better with alumina abrasives. A 3½-in. wheel is regarded in most shops as an economical size for cylinder grinding work. Most grinders recommend taking a roughing cut with a wheel and then truing it up and taking a final cut of about 0.0015 inches.

One plant has a system of having one man operate two machines. In one the cylinder is rough-turned and is then allowed to cool while the man proceeds to finish-grind the first one. It takes 15 minutes to cool a cylinder in summer and somewhat less in winter. Most shops take about one hour to each bore and usually five hours per six-cylinder block.

A brief description is given of regrinding crankshafts, a 36 grit, K grade wheel of artificial alumina type being recommended.—*Abrasive Industries*, July 6. 177.

Brittle Range in Low-Alloy Steels

Marcus A. Grossman, Metallurgist, Atlas Steel Corp., discusses the fact that the existence of a brittle range in steels containing a small percentage of alloy has been recognized for some time. When such steels are hardened and then drawn, there is a particular range of drawing temperatures which must be avoided because the steels which have been drawn in that range are quite brittle. That is to say, in order to impart toughness to a quenched steel, the steel may be drawn progressively up to a certain temperature, and then if further toughness is desired it is necessary to increase the drawing temperature suddenly several hundred degrees, as any intermediate ranges cause brittleness. Dr. J. A. Mathews of the Crucible Steel Co. has called attention to this phenomenon in chrome-molybdenum steels and the British Institution of Automobile Engineers has reported that a similar phenomenon is in evidence in chrome-nickel steels.

Mr. Grossman shows that this probably occurs in all low-alloy steels and is due to the fact that a small amount of austenite is retained as a structural constituent when the steel is quenched. This austenite is stable up to a certain drawing temperature, but is then broken up more or less completely, depending upon the temperature.

The method of detecting this is very sensitive and can be followed readily by observing changes in length of suitable specimens.—*Iron Age*, July 17, p. 149.

Minimizing Lamp Theft in the Shop

The magazine of the Nela Park Cleveland organization gives a most interesting article by James M. Ketch on the problems that arise in industrial plants at times when thefts of lamp bulbs seem to take place. This means, of course, that lamps suffer from rapid "consumption" and to overcome this three methods may be employed: 1. Installing a type of lamp which is unsuited for residential lighting; 2. Marking the lamp conspicuously so that its subsequent use reveals it as stolen property; 3. Employing mechanical devices or methods of mounting which make it difficult or impossible to remove the lamp from the socket.

Some plants change over their lines to a 230 volt system, which, however, on the basis of lamp replacement makes this an expensive solution of the problem as 22 per cent of the lamps must be stolen to make up the difference in cost. There is also a pronounced difference in the amount of current required per candlepower which shows up in the cost from the use of higher voltage. There is the use of freak lamps with left-hand thread bases, foreign bases and bayonet-type bases, which are generally to be discouraged because they are in opposition to the policy of economy of standardization and since such measures would cost a lot more than any saving that could be effected from prevention of theft. This leaves us, therefore, with one effective solution and that is to place the trade mark or name of the company on the lamp, sometimes even putting on "Stolen from blank works." In addition there is also the possibility of locking the lamp in the socket or placing a locked guard about the lamp.

Some illustrations are given of these various designs which may offer some suggestions to plant superintendents and store keepers.—*Light*, August, p. 21.

Modification of the Fatigue-of-Metals Theory

The Engineering Experimental Station at the University of Illinois has issued a Bulletin (No. 142) in which it defines the fatigue of metals as the action which takes place in metal parts subjected to repeated stresses causing failure of the metal at stresses well below the static ultimate strength. The reviewer of this bulletin takes exception to the statement that "fatigue is an action" and thinks it would be preferable to put in that "fatigue is a state induced."

From the tests it seems probable that the short-time test for determining endurance limit by the rise of temperature of a specimen subjected to some hundreds of cycles of reversed stress and the short-time test for determining endurance limit from the load-deflection diagram for a rotating beam determine the beginning of appreciable slide within the crystalline grains of the metal rather than the beginning of fatigue fracture.

Fatigue failure starts at some minute region of high localized stress and its beginning is a tearing apart of minute pieces of metal. Fatigue failure proceeds by the spreading of the minute fissures thus formed. These may be, but are not necessarily, the sequel of slip along cleavage planes within the crystalline grains of the metal. It is also possible that the repeated stress produces both strengthening effects and destructive effects in the metal. A statement is made that the ordinary formulas of mechanics of materials are based on the assumption of homogeneity of material and of regularity of stress-distribution throughout the material, and these assumptions imply a much simpler condition than actually exists in metals but they give a picture which may be regarded as accurate in a general statistical way.—*Auto Ind.*, July 17, p. 161.

S.A.E. Production Show Possible

A brief note states that an automotive production equipment show in the fall to be held in connection with the fall production meeting of the Society of Automotive Engineers, October 22-24 in Detroit is a distinct possibility.

The marked success of the service equipment show last May has proved a stimulating experience and the Council has modified its previous resolution to the extent of expressing the readiness of the Society to not only cooperate but to join with others in fostering a machinery exhibit. It is believed that there is a strong sentiment in favor of carrying the project through.—*Auto Topics*, July 12, p. 827.

Estimated Automobile Production in 1924

James Dalton, an authoritative writer on economics and finances in the automotive industry, believes that 1924 production and sales will be about twenty per cent less than 1923 although this will be in itself twenty-five per cent greater than in 1922. Many factors are affecting sales this year—too optimistic schedules for one thing, the weather for a second, politics for a third, the used car situation for the fourth, and general business conditions for a fifth. Money, however, is cheap and plentiful and there does not seem to be any basic economic reason for present conditions. In other words conditions are such that no serious depression can be recorded and the falling off is more a falling off on anticipations for a record year and the falling off of general business.

Mr. Dalton says that the automotive industry never has had what can be characterized as a normal year and has no definite notion of what constitutes an average annual demand and that this is a serious handicap to manufacturers in fixing production schedules. The number of first-car buyers, is, of course, diminishing every year and the time is measurably near when almost the entire market will be of a replacement nature. There is also a tendency growing among owners toward getting greater use out of a car. Retail prices may be expected to go up notwithstanding economies from lower material costs.

The whole article is a very valuable presentation of conditions as they actually exist in the industry at present. —*Motor*, July, p. 22.

Coal Storage

J. F. Springer contributes some information on the question of spontaneous ignition of stored bituminous coal. The coal first of all absorbs oxygen rapidly and this process is accompanied by the evolution of heat and the increased temperature of the coal mass produces a further avidity for oxygen. So the processes go on until combustion takes place. Circulation increases the temperature in the coal pile. The most perfect remedy is to provide for submergence of the coal in suitable bunkers. This is done by the United States Government at the great coal depot at the Panama Canal and we believe is also done by the Underground Railways of London and some of the very largest users of coal throughout the world.

Should, however the coal pile become ignited, it is a curious fact that playing a stream of water is not an especially good remedy. The better one is to dig out the affected coal. Continual watch should be kept of temperatures in the coal pile, preferably by means of vertical steel tubes located at suitable intervals, each tube enclosing a rod which may be pulled out and the temperature felt by hand.

Mr. Springer lays out the following rules: Store all coal in low and narrow piles; avoid storing fine coal; avoid subjecting the stored coal to external heat, such as the heat from nearby furnaces; increase care and attention where the coal in storage contains sulphur in the form of iron pyrites or any other substance eager for oxygen.—*Scientific American*, August, p. 104.

All-Steel Tubular Welded Structures

These articles describe the steel tube fuselages as used on various airplanes and attention is drawn to them because it is possible that similar structures may be evolved for other purposes. The method of making them is as follows: On large tables on which the shapes of the sides of the structure have been drawn out, the tubes are cut to length and put together temporarily, and are held in position between angle irons. They are then point-welded and the fuselage sides are removed and the joints finished off. The cross-tubes are next welded in place and the small quadrants in the corners are inserted. The fuselage is then placed in a rigging jig, the double wires put in and tightened and the fuselage structure is completed. It is possible that structures such as this may be of value for other work.—*Aviation*, June 9, p. 614, June 16, p. 642.

Machining Automobile Crank Shafts

W. E. Groene takes up the lathe operations in finishing crank shafts. The machining of this part involves problems of great complexity which have all been solved. Mr. Groene's article details the various steps toward the final satisfactory results and the article is increased in value by the machining times given for the different operations. —*Machinery*, July, p. 855.

Precautions Needed in Production of Automotive Drop Forgings

The crank shaft manufacturer has had many problems to fight these last few years with the coming of the six- and eight-cylinder vertical engines, as well as by the constant increase in engine speed which has necessitated much more accurate balancing.

This article discusses mostly the work of the Wyman-Gordon Company of Worcester, Mass., and goes into the question of first selection of steel and the elaborate means which are taken to insure that each piece of steel gets its own heat treatment so as to bring out the best qualities of the metal.

A tabulation is given of different groups of steel showing the elasticity and Brinnell hardness together with the chemical constituents.

One of the most important problems facing the forging manufacturer is to have proper control of his furnace temperature. How this is done is described in detail. From this point the article returns to the discussion of certain material defects and the metallurgical scrutiny necessary to determine these.—*Auto Ind.*, June 26, p. 1388.

Maintenance of Plant Equipment at Westinghouse Electric Co.

In the organization of the maintenance department the superintendent is responsible to the works manager for all repairs. The general foreman of maintenance reports to him, and he in turn has foremen and their assistants of sections under his direct supervision. These sections comprise most of the building trade and also a general foreman of wiring and lamp repairs.

From ten to fifteen men continually clean the 2,570,000 sq.ft. of roof, repairing gutters, slates and cracks in the skylights. Slate roofs are gradually replaced with gravel roofing, which has proven more satisfactory.

The plant contains 4,078,000 sq.ft. of flooring, mainly paved with asphalt blocks 3x5x12 inches, which makes a good floor but has a tendency to crumble and is being gradually replaced with vitrified block. Concrete and wood paving blocks, which have been found most satisfactory are also used.

Throughout the works are 28,000 electric light globes and reflectors. Two men clean these in the general offices and four in the shop. They use a hand truck equipped with renewable holders for carrying 100 clean reflectors. They also make all necessary globe replacements of which there are about 8,000 a month.

There are two organizations in the plant for fighting fire, one of which, the First Aid Fire Department, is composed of twelve groups of eight men each. Fire practice is held once a week and they answer calls for help in the area in which they work. The second is a regularly organized fire department of two captains and thirty men. A dormitory is maintained for these men, and a certain number are on duty at all times. Regular fire drills are held.

Eleven oilers and one group leader care for the 11,200 feet of line shafting, and the 1,800 countershafts. Each man is assigned a certain area containing about 180 countershafts.

There are nine belt stations throughout the shop for all of which this department is responsible. Most of it consists of oak-tanned leather from 1-in. single- to 92-in. double-ply in the shop, and up to 40-in. 3-ply for test floors. All new belting is dressed in a heated mixture of sperm oil and tallow. In some instances the life of the belts has been increased from an average of from four to six years to twelve years continuous operation. — *Management and Administration*, July, p. 43.

Economical Use of Diamond Tools

F. E. Koebel discusses the importance of taking care of diamonds used in grinding work. By timely resetting and careful use a diamond rendered service for 48 weeks. With average use and delayed resetting this was reduced to 40 weeks, but with careless use and disregard of resetting the diamond was destroyed in 28 weeks.

Illustrations are given of resetting methods and of gaging the time to reset the diamond.—*Abrasive Industries*, July, p. 180.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

Paying for Firing Men

ONE feature of the new shop plan of the Delaware & Hudson Railway is particularly noteworthy because of its being novel from every point of view. This is the paying of a $15-a-week wage for six weeks whenever a man is laid off or discharged for any reason. No matter why he is relieved from duty, he has $90 coming to him unless he is recalled sooner. The specially unusual feature is that it applies to discharge, from whatever cause, as well as for lay-offs.

The chief value of this is of course psychological. Every worker knows that no company is going to allow him to be laid off without cause, or fired for the whim of any foreman, when it costs them $90 in cold cash to do so. Under such a system every man feels that he has the assurance of getting a square deal and this counts in his attitude toward his work and toward the company.

Congressional Inaction Delays Aviation

THE necessity of Federal legislation of aircraft activities has been pointed out many times, and though there was an acceptable bill before the last Congress, partisanship and the unusual amount of log rolling prevented its even coming up for discussion. Congress has not been backward about regulating industry as a whole, usually against the protest of said industry. Here is a case where a vital industry begs for regulation and Congress turns a deaf ear to its pleadings.

The United States is the only country where air transportation is not regulated. Anyone can buy a plane of any kind, in any condition, and not only fly it, but can carry passengers. There is no inspection of the plane or of the pilot. He is at liberty to endanger the lives of passengers and those on the ground beneath and Congress refuses to take any interest in the matter.

An American aviator landing in Canada is an outlaw and cannot again take the air until his plane has been inspected and approved, and his own ability as a pilot proved to the satisfaction of the authorities. And the airplane is an American invention and development.

As a result of the indifference of Congress to afford protection to legitimate enterprises, the Aeromarine Airways Corporation is suspending operations for the present. They have invested over half a million dollars in building up air travel. They have carried over 30,000 passengers more than a million passenger miles with but one serious accident. They are probably the only large aerial transportation company in the world not enjoying a government subsidy. But they are suspending service because any wild-cat plane, which is a menace both to passengers and those beneath, has the same right and privileges as a well-established corporation which has done so much to prove the safety and practicability of air travel.

This company is not asking for a subsidy. It is merely asking that Congress follow the course of every other civilized government and enact suitable laws regulating and controlling air travel. And it is to the interest of all of us that such legislation be passed.

The development of aviation means more business along many lines. For that reason alone all the readers of the *American Machinist* should make their representatives in Congress feel that this is an urgent matter. But beyond, and of even greater importance, is the effect of aircraft development on national defense. We are now the weakest nation in the air where we should be strongest. Not so much with planes of the Army and Navy, as with planes of commercial companies which should form a splendid training school and a great reserve.

Insuring Men in the Shop

GROUP insurance has become common practice in nearly all sections of the country. There are, however, different methods which have been worked out according to varying ideas of management.

One concern gives each employee a policy for $1,000 providing he takes out some insurance of his own as well. The company does not dictate the amount of policy held by the individual but feels that each person should be enough interested in having insurance to have at least a small policy of his own.

Another firm gives each employee a policy for $500. After that the company pays half the premium up to $5,000, depending on the earning power of the insured. This same company provides group policies covering accidents and sickness, whether or not these occur while at work. These policies do not cover cases coming within the scope of the Workmen's Compensation or the Federal Liability Act, because in such cases the men are already protected.

These are some of the new problems of management. And on the way in which they are handled depend, to a great extent, the harmonious relations of the future.

Are We Looking or Seeing?

THERE are two ways of matching work and machine tools. One way is to build a tool and then begin to look around to find what work may be lying around which can be done on that type of machine. The other is to take a careful inventory of work to be done and then build a machine to suit.

The first method—if method it is—is the more common. Reduced to its simplest elements, it is merely the building of a general utility machine, or better yet, it is the building of a machine for some definite operation. drilling, or turning, or milling. It was the logical thing to do in times when turning was turning and drilling was drilling; but now it is different. Operations are specialized. The turning of a shaft in the lathe is no longer the same thing as the turning of a bevel gear in the screw machine. We recognize this well enough and speak of "forming" the bevel gear, but of "turning" the shaft and provide a different machine for the purpose, though both operations produce round pieces.

We do not recognize such differences in many cases, although they would be plain enough if we were but *looking* instead of being satisfied with *seeing*.

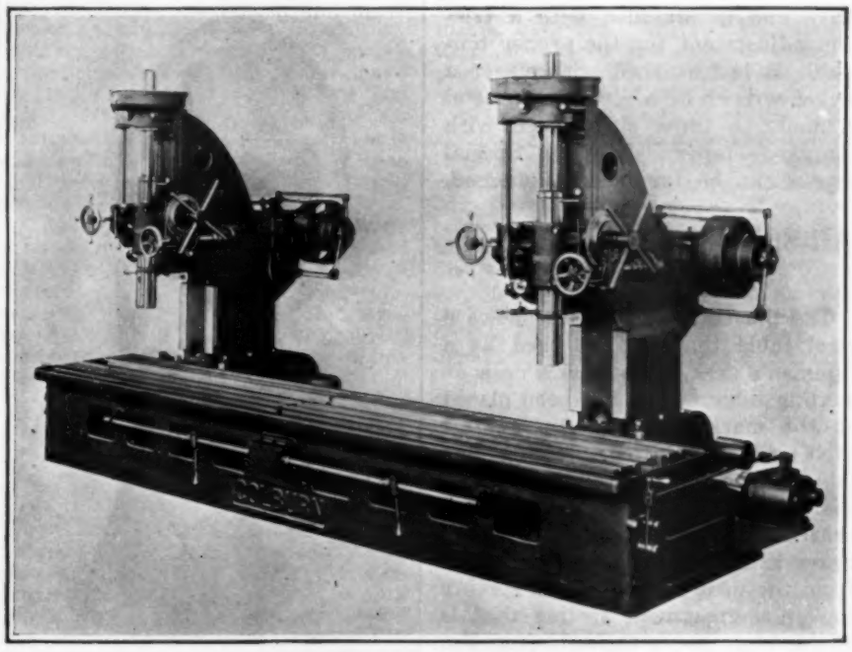
To what extent are machine tool builders looking?

Shop Equipment News

Colburn Locomotive-Rod Boring Machine

The advanced type of rod-boring machine shown in the accompanying illustration is a late product of the Colburn Works of the Consolidated Machine Tool Corp. of America, Wilmington, Delaware.

The machine is adapted not only to boring side rods, but on account of its great range, quick adjustment of heads to any desired position and the large number of speeds and feeds available, it can be used on a variety tudinally. Driving and feed gears run in oil. Driving shafts and spindles have ball bearings. A steady support and cutting compound pump for each spindle are a part of the regular equipment. A cutting-compound trough surrounds the bed. The spindle drive, feed mechanism, etc., are the same as used on a regular D-8 machine.



Colburn Locomotive-Rod Boring Machine

of work where two holes are to be bored, drilled, faced, reamed or tapped simultaneously, or where one operation may be performed on the first spindle and another operation on the other spindle. Each spindle is operated independently. If desired a tapping attachment may be applied to either head and for extremely heavy boring and tapping a tapping hood is recommended. Each spindle is driven by an independent motor which travels with the head. The motors also furnish power for moving the heads longi-

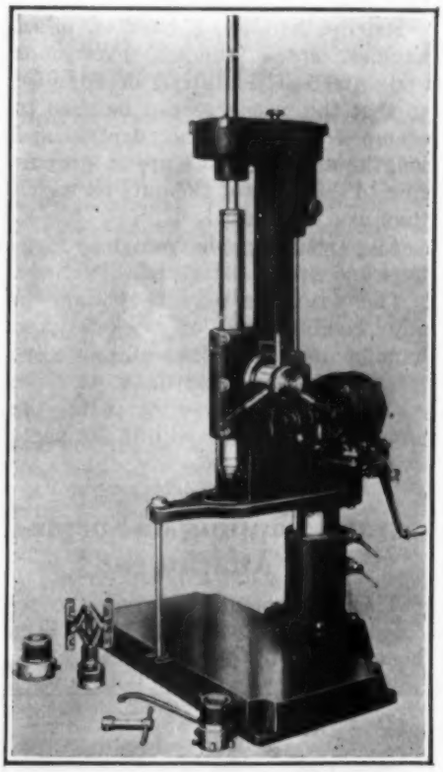
The specifications of the machine are as follows:

Drilling capacity in steel, 5 in. Boring capacity, 15 in. Swing, 36 in. Working surface of table, 28x 173 in. Vertical travel of spindles, 18 in. Maximum distance from spindle nose to table, 30 in. 8 speeds and 6 feeds for each spindle. Taper in spindles, No. 6 Morse. Motors, two 15 hp. constant speed, to run at 1,200 r.p.m. Motors not part of regular equipment and furnished only as extras. Net weight, 35,000 pounds.

Cincinnati "Borhonizing" Machine

The John Steptoe Co., Cincinnati, O., is now building a machine for the reconditioning of worn cylinders from all kinds of motor vehicles. As this is a combined boring and honing machine, it has been given the combination name indicated in the title. The machine is portable, and is equipped with a ½-hp. motor which operates from a light socket.

The machine is designed to handle cylinders from 2⅜ to 6 in. in diameter and 15 in. long, whether single cylinders or in blocks of 4, 6 or 8 cylinders. The spindle is 1¼ in. in



Cincinnati "Borhonizing" Machine

diameter and the machine is equipped with two boring heads, one for small and the other for large cylinders, together with one honing head, with stones, having a large range. The boring heads are self centering and are designed to leave the bore true and smooth, the hones removing all tool marks.

Husky Standard Wrench Set

The Husky Wrench Co., Milwaukee, Wis., has placed on the market the combination wrench set illustrated.

The full set includes sockets for hexagon nuts from $\frac{7}{16}$ to $\frac{1}{2}$ in. varying by sixteenths, except in two

Husky Wrench Set

cases where thirty-second sizes are furnished.

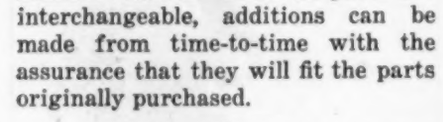
Ratchet handles, T-handles, offset handles, crank handles, extensions and universal joints can be supplied so that the wrenches can be used in cramped places. The depths and lengths of the sockets are in proportion to the sizes of the nuts on which they are to be used.

All parts are made from drop forgings and are heat-treated.

The wrenches may be bought in any combination of sockets and handles desired. Since all parts are interchangeable, additions can be made from time-to-time with the assurance that they will fit the parts originally purchased.

Strand Lapping or Surfacing Attachment

The attachment shown in the accompanying illustration has been brought out by N. A. Strand & Co.,



Lapping or Surfacing Attachment

5001-5009 N. Lincoln St., Chicago, Ill., and is designed for operation through a flexible shaft.

The attachment is made in two types, one with worm-gear drive for comparatively slow speeds, and the other with bevel-gear drive where higher speeds are required.

The device is made in several sizes and the lapping plates can be furnished in various diameters.

Strand Screw-Driving and Nut-Setting Attachment

The device shown in the illustration is intended for use in the drill press for driving screws and setting nuts, and has lately been placed on

Attachment for Driving Screws and Setting Nuts

the market by N. A. Strand & Co., 5001-5009, N. Lincoln St., Chicago, Illinois.

The device has a spring-clutch drive and is provided with a friction adjustment for the proper tension. It is furnished with either a socket wrench or a screwdriver, and is made in three sizes fitted with standard taper shanks. Special shanks can be furnished if desired.

All-Steel Mailing Table or Foreman's Desk

The illustration herewith shows a steel table that can be used as a foreman's desk, shop clerk's desk or mailing table, which has been placed on the market by the Angle Steel Stool Co., Plainwell, Mich. The table is made entirely of heavy steel, the parts being riveted together and braced to withstand strain and heavy loads. The table-top is 30 in. from the floor and carries a sorting top or compartment section that is 12 in. high above the table-top and is 15 in. deep, the back being flush with the back of the table. Each compartment is 10 in. wide by 15 in. deep by 3 in. high, and all compartments are closed at the rear end by a sheet metal back. The horizontal trays can be pulled out if desired, to make larger compartments. The working-space on the table-top in front of the compartment section is 18 x 40 in. The table is finished with a dark-green enamel, baked to obtain a smooth finish.

All-Steel Foreman's Desk

Buffalo Man-Cooler Fan

A fan for supplying a current of air to workers in steel mills, foundries and other places where heat is intensive, has been brought out by the Buffalo Forge Co., 490 Broadway, Buffalo, N. Y., and is shown in the illustration.

The fan is made in two sizes having fan wheels of 30 and 36 in. re-

Buffalo Man-Cooler Fan

spectively. While the fan is of heavy construction, it can be easily moved from place to place. The fan wheel has ten blades, so designed as to deliver the air in a solid stream and is enclosed in a substantial screen.

Power is supplied by a direct-connected motor at the rear of the fan wheel, the motor for the 36-in. fan being 3 hp. while that for the 30-in. fan is 5 hp. The speed for both sizes is 900 r.p.m. It is claimed that the motors are large enough to operate the fans continuously under the most severe conditions.

News of the Week

German Manufacturers Seeking Patents in the United States

Will resume active competition in many lines in this country

The records of the United States Patent Office at Washington show a determined effort by German manufacturers to recapture their monopoly of certain lines of commerce in this country lost through the World War, according to a statement made recently by Munn & Co., patent attorneys. The statement said the Patent Office was granting patents at the rate of thirty a week to residents of Germany.

"This is especially significant when it is considered that in 1913, the last full year before the World War, when German production and German exports were at their peak, 1,433 American patents were granted to Germans," the statement continued. "If the rate thus far this year is kept up, and applications still pending indicate that it will keep up, there will be more than 1,500 patents granted to Germans this year.

"These patents are not for luxuries or trivial notions. For the most part they are for chemical compounds, processes of manufacture and developments in metal and electrical lines—developments which mean real progress in the application of science to industries in all parts of the world.

"Sixty per cent of the patents being issued already are assigned to German manufacturers. Presumably most of the others are transferred to the manufacturers after the patents issue; a foreigner generally does not go to the trouble and expense of taking out a patent in the United States unless there is some assurance of profit.

"That the German manufacturers intend to sell their products in the United States is clear from the mere fact that the patents are sought in this country. American manufacturers, of course, will not be allowed to make or sell the same or similar products unless licensed by the German concerns.

"There is little doubt of the financial ability of the German manufacturers to carry through their plans for a commercial invasion of America. Not only has German industry steadily been strengthening its financial position, but the Reich Treasury is said to be showing a remarkable improvement each month, so much so that it is expected that Government funds will be loaned to the manufacturers of all kinds of merchandise for the purpose of advancing their business."

What the Railroads Are Doing

Increases in the movement of grain and grain products, forest products and miscellaneous freight were the outstanding features in the car loading figures for the United States for the week ended July 19, which were made public by the Car Service Division of the American Railway Association. Total loadings for the week were 930,284, the largest for any week this year since March 1, when the loadings of coal were exceptionally heavy on account of the threatening coal strike at that time. Compared with the previous week the loadings increased 19,869 cars, but they were still 99,145, or practically 10 per cent under the same week of last year.

The Conley Tank Car Co. purchased the business and equipment of the Keystone Car & Equipment Co., thereby acquiring 260 standard steel tank cars.

Tentative schedule of the Baldwin Locomotive Works calls for sixty per cent operation during August, compared with fifty per cent in July, according to President Vauclain. This will mark a new high point for the year and nearly treble the rate of operations January 1. President Vauclain still expects the plant to reach a one-hundred per cent rate by the first of next year.

The June earnings statement of 51 major Class 1 roads, just reported, show gross revenues of $369,025,000 against $431,368,000 for the same carriers in June, 1923, or a decrease of 14.4 per cent.

Net operating income of these roads totaled $52,991,000 against $63,520,000 the previous June, a decrease of 16.6 per cent. In May this year they earned net of $48,312,000, June showing increase of 9.4 per cent.

Subsidiary companies of the United States Steel Corp. are credited with having received orders for 30,200 tons of steel rails during the past week. Inquiries are in the market for 20,000 additional tons and several orders for freight cars.

Cars on Canadian lines total 198,511, increase of 3,600 since first of July; bad order cars down from 18,037 to 17,811, but surplus cars up from 22,230 to 25,168. This is also high point for year, previous high being 24,063 at mid-January. Evidently Canadian roads are accumulating cars for crop movement.

The Delaware, Lackawanna & Western's showing net operating income of $7,281,000 for the first six months of this year establishes a record for the road and promises, if earnings through the remainder of the year equal those of a year ago, that 1924 net operating income should approximate $15,350,000, and leave about $8.50 a share ($50 par) on the $87,277,000 capital stock, if charges and non-operating income were the same as in 1923.

The New York, New Haven and Hartford Railroad is not seeking control of the Boston and Maine Railroad, but wishes proportionate representation on its board of directors in order to safeguard its interests, says Elbridge R. Anderson, appointed as Master by the State Supreme Court.

Spain Is Buying More American Machinery

Further increases in sales of American industrial machinery were registered in Spain during the past year, when United States exports to that country jumped from $1,370,868 in 1922 to $1,839,934 in 1923, or an increase of 34 per cent, according to the Industrial Machinery Division of the Department of Commerce. Conservative estimates, in the opinion of the Division, are that 1924 will produce as great improvement if wise attention is given to current market conditions throughout the year.

This $469,066 increase in 1923 was distributed among the following branches: Construction and conveying machinery, from $84,138 to $115,422; mining, oil-well, and pumping machinery, from $154,167 to $406,119; metal working machinery, from $228,815 to $280,350; textile, sewing, and shoe machinery, from $168,843 to $170,447; and miscellaneous machinery, from $573,776 to $773,519. Power-generating machinery, except electric, alone showed a decrease, dropping in value from $161,129 to $94,077.

The increase of construction and conveying machinery took place in spite of a drop of over $28,000 of American exports of steam and other power shovels.

The increase in shipments of this class of machinery to Spain was caused in part by increased activity in the coal mining industry throughout 1923. Lead mining was also at the peak of production in the first half of the year, and iron mining was carried on a slightly larger scale during 1923. Spain has developed her petroleum reserves and a gradual increase in shipments of oil well drilling machinery may be expected.

Plan Industrial Trip to Mexico

Plans have virtually been completed for the visit to Mexico of a group of prominent American industrialists and bankers in September. The trip, which will have the object of surveying conditions in Mexico and reviving business friendships, will be undertaken at the invitation of Marcos E. Raya, Mayor of Mexico City.

The State Department at Washington has sanctioned the trip, according to William Wallace Nichols, president of the American Manufacturers' Export Association, through which organization the invitation was extended. The Mexican Government regards the proposed trip as "the greatest move Mexico has made in fourteen years for business and friendship between the United States and this country."

The mission will be met at Laredo by special representative of the Mexican Government and will be escorted with military honors to Mexico City. A series of official receptions and conferences will be held in the capital. It is expected that the mission will leave New York by special train on Sept. 8 and arrive in Mexico City on Sept. 13. Among those who have indicated their intention of accompanying the mission, according to Mr. Nichols, are Frank D. Waterman, George Ed. Smith, and Samuel Vauclain.

News of the Automotive Industry

The name of Apperson is to remain in active automobile circles, it has been announced from Kokomo, Ind., the home of the factory. A complete re-organization has been effected in the company, whereby the Apperson Brothers Automobile Co. has leased its plant for five years to a new corporation to be known as the Apperson Automobile Co. By the terms of the reorganization, the new company is to operate the plant and carry forward all branches of the business. Arrangements have been made for ample working capital and operations will commence at once. The rights of creditors have been protected, it is said. The capital of the new company consists of $200,000 in preferred stock and 10,000 shares of no par-value common stock.

Net profits of the Studebaker Corp. in the second quarter of the year showed a satisfactory improvement over the totals for the first three months, amounting to $4,030,000 as compared with $3,542,000 in the first quarter, it was announced today. Directors ordered the regular dividends.

The Ford Motor Co. for first six months of 1924 reports sales of 1,074,227 cars, trucks, tractors and Lincolns, a new high record. Sales of 1,026,978 cars and trucks were fifteen per cent greater than the best previous record made during the first half of 1923 when 893,883 cars and trucks were sold.

Lincoln sales for this period totaled 4,015, an increase of forty-two per cent over best previous six months. Tractor sales continued at practically the same rate as in 1923 with 43,234 deliveries. June sales of tractors, however, were thirty per cent greater than the June record of a year ago, according to the company's statement.

The Eaton Axle & Spring Co. reports net earnings of $135,358 for the three months ended June 30, after all charges. This is equal to 61 cents a share earned on the 220,000 shares of no par value capital stock outstanding. For the six months ended June 30 the company reported earnings equal to $1.12 a share.

The Continental Motors Corp. the largest merchant builders of automobile engines, will increase its August manufacturing schedule 33 per cent in excess of July.

Incorporation of the Flint Malleable Castings Co., with $500,000 capital, for the purpose of constructing a large plant for the manufacture of automobile castings has been announced by a group of Flint, Mich., business men. The main plant of the concern will be built on the Flint Belt Line Railroad in the new east side industrial section of the city of Flint.

Net income of the Pierce Arrow Motor Car Co. in the second quarter of the year amounted to $138,000, equivalent to $1.06 a share on the preferred stock after allowing for prior preference dividends.

In the corresponding period of 1923 net profits were $162,000, equivalent to $1.31 a share on the preferred, while in the previous quarter the earnings were equivalent to 47 cents a share. In the first half of the year net income was $216,000, or $1.53 a share, as compared with $267,000, or $2.04 a share, in the corresponding half of 1923.

State Public Utilities Commission of Michigan has granted permission to Detroit United Railway Trucking Co., a subsidiary of the Detroit Railway, to operate motor trucks between Imlay City and Harbor Beach and touching intermediate points in the "thumb" district of Michigan. Combination truck and trolley service started July 28 and provided 24-hour delivery on shipments to and from Detroit. This is a big improvement over former service to these points which required from three to four deliveries and is expected to result in much new business for the Detroit United Railway.

Reports that Hupp Motor Car Corp., Detroit, will discontinue its present four-cylinder model are denied by the company, however, an eight-cylinder Hupmobile will be placed on the market as well as a four-cylinder commercial vehicle. The Eight will be made in the former plant of the Detroit Electric Co. which was taken over by the Hupp concern some time ago and which is being fitted out for that purpose. During the first half of this year approximately 18,000 Hupmobile cars were sold as compared with about 24,200 for the first six months of 1923.

Increase in Exports of Machinery

Exports of metal-working machinery during June, 1924, with revised comparative figures for June, 1923, as compiled by the Department of Commerce, are as follows:

	June, 1923 Value	June, 1924 Value
Lathes	$72,503	$94,133
Boring and drilling machines	44,710	34,018
Planers, shapers and slotters	26,855	27,364
Bending and power presses	10,703	24,192
Gear cutters	9,914	33,438
Milling machines	34,680	70,028
Threadcutting and screw machines	36,384	30,500
Punching and shearing machines	12,689	4,956
Power hammers	7,158	26,342
Rolling machines	485	10,238
Sharpening and grinding machines	72,034	.....
External grinding machines	.....	130,362
Internal grinding machines	.....	72,242
Other grinding and sharpening machines	.....	35,884
Chucks for machine tools	24,344	27,531
Reamers, cutters, drills, etc.	164,433	147,560
Pneumatic portable tools	64,896	95,704
Foundry and molding equipment	26,246	63,031
Other metal-working machinery amd parts of	370,684	462,682
Metal-working machinery Total	$1,000,718	$1,390,205

Management Congress in Brussels

A general invitation has been sent to this country by the Congress International de l'Organization Scientifique de Bruxelles to a congress to be held at Brussels, Belgium, during the month of July, 1925. According to a letter recently received, the organization is similar to that of the Taylor Society in this country.

The program for the congress has been condensed to six points: Definition of Scientific Organization; Industrial Psychology, the Science of Work and Technical Organization of the Factories; Psychology of Work, Social Insurances; Moral Rehabilitation of Work, Relation Between Capital and Labor, the Discipline of Work; the Factory and the Home of the Workman, Architecture and Management with a View to Furnish Comfort; the Formation of the Scientific Organization.

Two Scholarships Given by B. G. Lamme

Two scholarships for mechanical and electrical engineering courses at Ohio State University, Columbus, Ohio, are provided by a fund of $15,000 set aside by the late Benjamin G. Lamme, formerly chief engineer of the Westinghouse Electric and Manufacturing Co. and widely known in the engineering and electrical industries.

In addition, $6,000 is provided for a gold medal to be given annually to graduates for meritorious work in engineering. A similar medal is made possible for engineering teachers. A third medal will be awarded annually by the American Institute of Electrical Engineers to a member for advancement in the development of electrical apparatus.

The Condition of British Business

Exports and imports for the first six months of the year—Automotive business and machine tool trade—Possibilities of a strike—The results of the exhibition

By Our London Correspondent

THE issue of returns on overseas trading for the first six months of the year affords an opportunity for a little stock-taking, and it will be seen that compared with a year ago conditions have been more favorable. Valued at nearly 598½ million pounds, imports increased by 11 per cent, while exports of British produce, valued at about 388½ millions pounds, increased by 1½ per cent, the total of exports, including exports of foreign and colonial merchandise, exceeding 462¾ million pounds, which is an increase of more than 3 per cent. If the comparisons were taken back another year, the gains would be more pronounced.

All the main classes of imports show an increase, but in exports a decline in raw materials, almost entirely coal, is balanced by an increase in manufactured articles. This improvement again is largely due to cotton yarns and manufactures, woolens and other textiles, and clothing also showing definite increases. The decline in coal export is a matter of public comment. The iron and steel trade looks hopefully towards the fall of the year but production figures, both of pig iron and steel, have of late declined and price-cutting has been practiced, with some affect on the stocks of pig iron.

The figures of unemployment have on the whole improved, although they have not gone below the one million mark, and the cost of living figures, after falling to the position of a year ago, show a tendency to rise.

Engineering Industry Quiet

It can hardly be claimed that the engineering industry has shared in the relative prosperity, although the exports of electrical goods and apparatus have increased in value and goods of the class entered as iron and steel show a still more marked advance for the six months, with declining tendency. But the decline in machinery is quite definite, the exports here being nearly 2¾ million pounds below those of the same period last year, while the vehicles class, which includes locomotives, ships and aircraft, fell away in the six months more than 6½ million pounds.

Despite the McKenna duty agitations, which undoubtedly caused hesitation in the home market, the motor car industry has shown improvement. Imports in this section are somewhat below those of the same period of 1923, and imports of motorcycles, etc., and their parts, and of ordinary cycles are of but trivial value, although the imports of cycle parts and of tractors also have somewhat increased. The imports of rubber tires and tubes very definitely declined and were only slightly in advance of the corresponding exports, which show a fairly marked increase.

While the values of exports of motor cars and their parts have not reached those of imports, they have increased very markedly and amount for the six months to 2¾ million pounds against 1¾ million pounds in the same period of 1923. Then motorcycle exports, with parts, amounted to 1¼ million pounds, tractors to more than ¼ million pounds, push cycles to nearly ½ million pounds and their parts to 1½ million pounds. The automobile industry, particularly the lighter cars, has kept up remarkably well and cycle firms have sold well to the continent of Europe and to India. The Ford Motor Co., has of course been established at Trafford Park, near Manchester, since well before the war. Once again it contemplates moving south, having, it is understood, acquired a site of more than 300 acres a few miles east of London, where, according to program, some 10,000 people will be employed.

Decrease in Machine Tool Exports

Machine tool exports have sagged, being valued for the six months at £598,552 as against £778,180 in the first six months of 1923. Local reports are somewhat conflicting. In one district it will be noted that the Continent of Europe is buying more, while another district will report that even inquiries from the same area are non-existent. The British dominions overseas continue to be the most profitable export areas for machine tools, India and Australia being the most prominent.

Political events have delayed the placing of orders pending in South Africa. Of foreign countries France, Japan, Belgium, certain Portuguese and Dutch possessions and Brazil and Chili are the most promising markets for British machine tools. The United States buys nothing from us in this line, but with Germany is predominant among the countries from which we import such goods.

In the engineering industry the electrical section is probably in the most satisfactory condition. Shipbuilding once again promises to revive.

The claim of the factory workers for an advance of 20s. a week in wages has failed. The exact effect, if any, of the refusal to advance wages remains to be seen, but in view of the facts given, a strike, while not impossible, is not very probable. The question is once more being considered by the trade unions concerned. It is only fair to add that the employers themselves have for long held that, compared with most other trades, engineering workmen are underpaid.

An increasing number of people in the country are skeptical of the value of exhibitions as a means of obtaining definite orders, and it was for quite different purposes than this that engineering firms took part at Wembley. It is certain that some expected very little in the way of direct orders and they have not been disappointed; in a few cases stands have been left without proper attendants. But the exhibition authorities are able to report that in the section organized by the British Engineers' Association the exhibitors are quite satisfied with the trade done and negotiations opened in the first three months, and this view is borne out by such inquiries as the writer has personally been able to make. But it is expected that more business will be done during the next month or so, when most of the foreign visitors will have arrived. As to electrical engineering, it is reported that "every manufacturer exhibiting in the sections states that he is highly satisfied with the results that have come to his effort."

The British Engineering Standards Association recently made a number of additions to their standard specifications, particularly in connection with automobile work. Thus new specifications have been issued relating to valve steels and valve forgings, to narrow-type concentric piston rings, to iron castings for air-cooled and jacketed cylinders, to sand cast pistons and valve guides, and to cast-iron flywheels, all as applied to automobiles.

Gives Eight Millions to Carnegie Institute

The Carnegie Corp. of New York, custodian of the bulk of the fortune left by Andrew Carnegie, has paid to Samuel Harden Church, president of the Carnegie Institute of Pittsburgh, an $8,000,000 addition to the endowment for educational work.

The gift had been under consideration for four years because of the handicap under which the institute found itself as a result of the war-time depreciation of the currency. The corporation required the institute to make certain changes in its educational scheme with regard to other schools in the Pittsburgh district, and also stipulated alterations in its financial policy.

"This is the largest gift ever made at one time for Pittsburgh education," said Mr. Church, "and is one of the largest ever made in the history of the world. It makes the total amount given to the Carnegie Institute by Mr. Carnegie and the Carnegie Corp. $38,000,000.

"There is still a further gift of $8,000,000 to be paid during the next twenty years on condition that the trustees of the Carnegie Institute raise $4,000,000 from other sources."

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price

Editor, *Commerce and Finance*, New York

(Copyrighted, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)

ST. BARTHOLOMEW'S Episcopal Church, whose members include many of the richest people in New York, has for thirty years maintained a benevolent organization and a pawn shop in the tenement house region on the East Side. It has recently closed both because there is no more poverty to relieve.

The life insurance business written in the United States during June and the first six months of the year is the largest on record. The same thing is true of the increase in savings banks' deposits.

On last Thursday a Santa Fé train two miles long left Newton, Kansas. It contained 360,000 bushels of wheat that had been sold for $396,000. July corn has sold at 1.14 in Chicago and December at .98¾.

At the conference in London the French submitted a compromise formula for the settlement of some of the questions that stood in the way of the German loan.

Its acceptance is predicted and the loan will probably be made.

The stock market continues strong and the business has exceeded a million shares a day for the last fourteen five-hour days. Bonds are likewise advancing and prime issues are becoming very scarce. New securities having a par value of $276,000,000 were publicly offered during July and most of them were readily sold.

Hogs are selling at over $10 and the packers have profited largely as their unsold stocks acquired at lower prices were large.

Copper is strong and active at 13¾ cents. Pig iron and steel are somewhat higher. More orders are being received and the stock of the steel corporation has advanced sharply upon the declaration of another extra dividend of 50 cents a share. It is generally assumed that this extra dividend will be permanent, thus putting the stock on a 7 per cent basis.

The market for raw cotton continues "fluctuous," but the undertone is confident. Prices are easily advanced when the weather is bad and they decline but slowly when it is favorable.

The automobile business is better. The concerns that make buses have all they can do for months ahead. And as there is much more rubber in bus tires than in tires for the ordinary car it is not surprising that rubber has advanced about a cent. Incidentally it is worth noting that our rubber imports for the first half of the year were but 162,174 tons as against 195,669 tons in 1923. A further advance in rubber would be logical.

Everyone knows that there is plenty of sugar for the present and but few expect an advance. But the price is slightly higher nevertheless and as low prices rarely fail to increase consumption it looks as if the few who are bullish may be right.

A dispatch from Moscow says that Soviet Russia faces a sugar famine because the beet sugar crop in the Ukraine is a failure. It is reported that the government has arranged for large imports of refined sugar from the United States.

Chicago bank clearings for July are 8 per cent ahead of last year. The weekly statement of the Federal Reserve Banks shows a gain of $24,000,000 in earning assets, which is entirely accounted for by the increase in Government securities bought or loaned against. The gold on hand is reduced by $12,500,000 and the reserve ratio is 83 per cent. A continued ease of money is indicated and is reflected in the New York money market where 30 day acceptances have sold at 1¾ per cent.

It is estimated that 300,000 American tourists will visit Europe this year and that they will spend an average of $1,000 each. This would be a total $300,000,000 which is about 40 per cent of the amount by which our merchandise exports exceeded our imports during the 12 months ending July 30, 1924. Loans made abroad, insurance premiums and freight paid foreign ships will probably make up the other 60 per cent, so that the $407,000,000 of gold that we imported would appear to represent the repayment of loans we made to Europe or elsewhere.

The international account current can never be precisely stated, but it is evident that it shows a big credit balance in Uncle Sam's favor and that he is becoming a very affluent old gentleman.

This paragraphic picture of our economic condition is presented because it is in such contrast to what we would have written ten years ago. For it is only ten years since the twenty-eighth of July, 1914, when the war was opened and business was paralyzed by Austria's attack on Belgrade. To those who have lived through it the intervening decade seems too short for the marvelous improvement that has taken place in the United States.

It seems impossible that anyone who intelligently studies the record have any genuine misgivings about the future. Of course we shall have our ups and downs and for the downs we must be prepared.

What's Doing in Industry

The month of July was a quiet one for the machinery and machine tool trade, but it was not without its compensations. More inquiries began to come in during the last half of the month and the entire tone of business brightened before the first of August was reached. So far in August, sales have improved and inquiries have increased so that dealers in all parts of the country are reasonably optimistic.

Railroads showed fairly good earnings during the first six months of the year, but this was done by cutting down operating expenses rather than any increase in business. During the last half of the year it is probable that more machine tools will be bought.

Japanese buying has started and reports from all sections state that builders of machine tools feel encouraged at this indication. Dealers will not share to any great extent in this purchasing.

Surplus automobiles that have been stored and new model machines are both moving better than at any time since March and predictions are that production will be increased but probably not until Sept. 1.

Freight loadings increased according to the last report issued, which is encouraging. The movement was mostly wheat and corn with some increase noted in general merchandise.

The stock market has been making and breaking records daily. Both the volume of trading and the value of shares have increased, all pessimistic rumors being discounted or entirely discarded. The bears are in full retreat, while the bulls present a united front. Rail consolidations and the usual extra dividend of the U. S. Steel Corp. —hardly anticipated—were the two subjects of discussion in Wall Street.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

New York

The month of July proved to be rich in prospects but poor in an actual orders in the machinery and machine tools market in New York, although there were some sales consummated. That July is never a brisk month must not be lost sight of, and this seasonal influence combined with the tailend of a minor depression did not make the figures any too cheerful.

But August opened up much better. During the first few days several sales to general industrials, some replacements to southern railroads and a larger number of inquiries than for any week in several months was the story with the dealers in New York. Predictions were freely made that August this year would be on a par with the early spring months and that the rest of the fall looked exceedingly bright. Optimism in the New York market was decidedly novel since April 15, but welcomed nevertheless.

The Japanese situation has occupied the attention of many of the larger dealers during the past week. Mitsui & Co. seem to have cornered all of the business and from rumors sales will go through this company for all machine tools. However this report is neither authentic nor final and sales for some of the smaller tools may be made through the dealers.

Used tools did not enjoy such an excellent month. Business this year has been good in the used tool market, but there was a let up in July partially seasonal and partially unaccountable.

Exporting continues at record figures for metal working machinery, and exporters are gratified with the large shipments being made.

Detroit

A lull in the machinery and machine tool market corresponding with the vacation periods in many of the leading industrial plants of this section has been noticed in Detroit during the past few days.

While nothing indicates that August will be a "slim" month in the matter of sales, there is a tendency not to expect too much until September when those in a position to know believe the automotive industry will resume operations on the same scale as during 1923 and the early part of 1924.

Not much new equipment is being purchased, although some special jobs are being secured by the larger machinery firms. Most automobile concerns are changing models but engineers are trying to keep purchases of new machines at a minimum.

A survey of the steel market shows that more tonnage is being released to motor car plants as inventories have run down. Employment figures announced by the Employers' Association show the first upward trend in weeks. More full-time schedules in factories are now in force than during the past two months.

Cincinnati

Machine tool manufacturers see a bright ray of hope in the tendency of general business conditions to improve. There is a general feeling that with rising prices for wheat, corn and other farm products there will be a return of prosperity to the agriculturists, and once more they will begin to buy liberally in the cities, and thus bring the manufacturing business back to a normal state.

"Farmers do not buy machine tools to any extent," said a prominent machine tool manufacturer, "but in normal times they buy much machinery and other things which it requires machine tools to make, and for this reason the machine tool industry is vitally interested in the prosperity of the rural part of our population. While the proportion of urban population has greatly increased in the past two decades, the farmers still form more than one-half of the country's potential purchasing power."

The upward trend of the stock and bond market is regarded as another auspicious omen for the return of prosperity to the machine tool business. "Railroads and other transportation companies are getting on a better basis," said the head of a large machine tool company, "and this is reflected in their stocks and bonds, which now are increasing in value after a long depression. It takes a lot of machine tools to keep the wheels of transportation going, and the return of prosperity to the railroads will mean an increased volume of business for us. I am sure that better times are near at hand."

Cincinnati machine tool builders report business quiet. All are doing some business, and no concerns seem to be shut down entirely, but every concern is working with a curtailed force.

Philadelphia

The general economic and industrial outlook in Philadelphia is encouraging. True, the centers of activity are suffering from the effects of the midsummer lull and expect to continue so to suffer for a while, but inquiries received by some of the machinery dealers and manufacturers are such as to give hope for an eventual recovery.

There appeared to be nothing in the situation this week which would indicate the hope for improved conditions will not be justified. This hope was expressed by some of the larger machinery and machine tool producers, based upon actual orders and many inquiries.

There are influences in the situation which may have a tendency to retard the expected recovery.

Most of the machine tool dealers and manufacturers are not pessimistic over the outlook, realizing the community and the country is passing through the difficulties it had anticipated following the overproduction period.

The Federal Reserve Bank of Philadelphia finds that the second quarter of 1924 has brought a greater demand for automobiles than the first, although the sales in the last three months were less than in the corresponding period of 1923. Second-hand cars are moving out of salesrooms almost as fast as they are brought in, reports to the bank show. Prices are virtually unchanged.

Cleveland

Prospects for better machine tool business for the Cleveland manufacturing and distributing interests, which appeared to be brighter early in July, do not seem to have materialized. The inquiry has been good, but the ordering has been quite the reverse. Not only does this apply with the heavy duty equipment producer, but with the lighter machine tool manufacturer as well. The latter, in fact, up to the moment, showed signs of real revival in the last two months.

In some instances crane interests are getting some benefit of outside industrial expansion, which itself is still quite limited, but better than in most manufacturing fields. Planers and boring mills have shown a like turn for the better, with a particular increase in the immediate Cleveland district, though inquiry and some ordering is coming from distant points as well. Only a few automatic machines have been called for in this vicinity in the last fortnight, and still fewer shears, punches and similar items.

Wherever orders are being placed it is well to remember, however, that the equipment thus absorbed is for replacement, and does not enter into new plant work, although from the real estate field in the immediate Cleveland district comes the claim that much new industrial activity may be seen here with the coming of fall.

Some indication of this is seen in the sale of the Winton company plant to a syndicate headed by Frank N. Riley, whose associates have not been revealed. The plant, which was formerly the home of the Winton automobile,

will be used, it is said for an entirely new industry. The Winton engine plant nearby is not included in this deal. The deal is said to have involved $500,000, and the purpose for which the plant will be used will be announced later.

Buffalo

There is a distinct tone of optimism among the Buffalo dealers, as compared with reports of two or three weeks ago. The reason for it is that the scattering orders for single machines which have been the bulk of the business for so long are increasing in volume with some dealers and most offices report a perceptible increase in the number and size of inquiries.

Another favorable indication is that most of the customers of machinery salesmen are talking more optimistically and looking forward to a pick-up by Sept. 1. In fact, most of the inquiries are of such a nature that they likely will not materialize into orders before that date, which probably means that August will not break any records, but there is a sufficient volume of business in sight for September to make most of the men in the business confident that conditions will be swinging back to normal by then.

One house dealing in steam specialties, such as gages and other things for high-pressure power plants, boiler manufacturers, railroads, etc., reports that business for the past three weeks has been running even with business for the same period a year ago.

U. S. Steel Continues Extra Dividend

At a meeting of the directors of the United States Steel Corp. held last week in the office of Chairman Elbert H. Gary, New York, an extra dividend of 50 cents a share was declared on the common stock in addition to the regular quarterly dividend of $1.25 a share. A favorable statement of earnings for the three months ended June 30 was the basis for the continuation of extra dividends on the common stock.

Business Items

The Rockford Tool Co., Rockford, Ill., has appointed the E. L. Essley Machinery Co., Chicago, the exclusive representative in the Chicago and Milwaukee districts for its products.

The Morse Engineering Co., St. Louis, Mo., has been appointed exclusive agent for the Ramsey Chain Co., Albany, N. Y., in the St. Louis district.

D. R. Clarkson & Co., Inc., of Rochester, dealers in machinery and engines, have closed their Buffalo office at 41 Erie St. Charles E. Perkins of 933 Elmwood Ave., Buffalo, continues in the territory as the Clarkson representative.

The Austin Machinery Corp. has moved its executive, sales and engineering offices from Toledo, Ohio, to Muskegon, Mich.

The Boston Gear Works Sales Co. has been incorporated to handle the marketing of the products of the Boston Gear Works, Inc., Norfolk Downs, Mass.

The Metal Craft Corp. has been incorporated at New Haven, Conn., to make and deal in mechanical articles of all kinds. The firm is capitalized at $150,000 and the incorporators are: Arthur J. Montague, Milford, Conn.; Gardner E. Wheeler; and M. C. Curran, New Haven.

The Shelton Adjustable Double Deck Car Co. has opened sales and distributing offices at 1019 Monadnock Building, San Francisco. The concern will manufacture in San Francisco an adjustable deck for freight cars by means of which the carrying capacity of the cars will be greatly increased.

The Remo Manufacturing Co., of Meriden, Conn., is selling its safety pin business to the Risdon Manufacturing Co., of Naugatuck, Conn. The equipment will be removed at once. The purchase makes the Risdon Manufacturing Co. one of the three largest manufacturers of safety pins in this country.

The plant, equipment and other assets of the Milholland Machine Co. of Indianapolis, have been sold by the receiver for $116,000. The sale was made to three separate companies. The plant has been kept in operation by the receiver, and, while more than making expenses, the income was not sufficient to justify re-organization under the heavy capitalization. The plant was sold to Paul Ragan, an officer of the Stutz Fire Engine Co., which will occupy the plant. Machine tools and general equipment was bought by Michael E. Panber & Co., a Chicago concern for $30,000, while the Gisholt Machine Co. of Madison, Wis., bought the business, special equipment and inventory for $40,000.

Personals

CLAYTON R. BURT has been made general manager of the Pratt & Whitney Co. plant at Hartford, Conn. He succeeds BRYANT H. BLOOD, resigned.

BRYANT H. BLOOD has resigned as manager of the Pratt & Whitney Co., Hartford, Conn., but will remain with the company.

W. G. NEVIN has succeeded T. H. KING as sales manager of the Landis Tool Co., Waynesboro, Pa.

H. L. WOOLFENDEN has joined the Scott Valve Manufacturing Co., Detroit, and will have charge of sales promotion.

PROF. A. LEWIS JENKINS, professor of mechanical engineering at the University of Cincinnati, will exchange positions with PROF. A. L. SCIPIO, dean of the engineering department of Roberts College, Constantinople, Turkey. The exchange will take place Aug. 15 and will be for about a year.

HENRY M. CUNNINGTON, formerly a member of the *Electrical World* staff, will have charge of the publication advertising and sales promotion work for the Robert Bosch Magneto Co., Inc., New York City. Mr. Cunnington has been with the organization since May.

E. W. GOLDSCHMIDT has been appointed Eastern executive representative of the Wagner Electric Corp., St. Louis. His headquarters will be in New York City.

HARRY E. WITHAM has resigned as manager of the Foster Machine Co., Elkhart, Ind.

THOMAS H. KING, with the sales department of the Landis Tool Co., Waynesboro, Pa., for the past eighteen years, has resigned and will become treasurer of the Wayne Tool Manufacturing Co., Waynesboro, Pa.

CHARLES PIEZ, president of the Link-Belt Co., Chicago, has been elected to the newly created office of Chairman of the Board and also chairman of the executive committee of the company.

GEORGE HUSH, JR., has joined the Buffalo office of Joseph T. Ryerson & Son. He was formerly in the Pittsburgh offices of Manning, Maxwell & Moore and the Consolidated Machine Tool Corp. of America.

FRANK T. GOETZ has been appointed sales manager in the Cleveland district for the Cincinnati Shaper Co. and the Cincinnati Gear Cutting Machine Co., Cincinnati. His headquarters will be at 314 National Building.

ALFRED KAUFMAN, formerly second vice-president of the Link-Belt Co., Chicago, has been elected president, succeeding CHARLES PIEZ.

RUEBEN S. CROSBY, for many years superintendent of the Asa S. Cook Co., Hartford, Conn., has been elected a director of the corporation.

D. A. CLEMENTS has been appointed representative for the Gibb Instrument Co., Bay City, Mich., for southern Illinois and the state of Missouri. His headquarters will be at 4167 Washington Ave., St. Louis, Mo.

A. C. JOHNSON has been elected second vice-president of the Link-Belt Co., Chicago.

JOHN F. COOK has been elected president and treasurer of the reorganized Asa S. Cook Co., Hartford, Conn. Until 1916 he was general manager of the company.

K. H. CRUMRINE, formerly with the Gisholt Machine Co. and the Milholland Machine Co., has joined the organization of the Cincinnati Shaper Co., Cincinnati, Ohio, as sales engineer.

HUMPHREY J. KIELY has been elected third vice-president of the Link-Belt Co., Chicago.

JOHN C. COOK has been elected assistant treasurer of the Asa S. Cook Co., Hartford, Conn.

RAYMOND H. SULLIVAN, who has just been elected to a vice-presidency of North & Judd Manufacturing Co., at New Britain, Conn., joined this organization eighteen months ago, coming from Yale & Towne Manufacturing Co., at Stamford, where he was superintendent of methods.

Obituaries

JOHN H. DUNLAP, secretary of the American Society of Civil Engineers, died July 29 in a Chicago hospital as the result of injuries sustained in the Chicago, Burlington & Quincy wreck at Buda, Ill., on June 30. He was returning from a meeting of the A.S.C.E. when the train was wrecked. Eight other people lost their lives. Mr. Dunlap was born in Harrisville, N. H., and was graduated from Dartmouth College in 1905. He was formerly a professor of hydraulics and sanitary engineering at the State University of Iowa and had also spent two years with the Reclamation Service.

GEORGE C. BARDONS of Bardons & Oliver, died July 29, in Cleveland. Mr. Bardons was 63 years old. He first worked with the Warner & Swasey Co. as an engineer. About 20 years ago he formed the firm of Bardons & Oliver with John G. Oliver.

CLAIRBONE PIRTLE, chairman of the board of the Electric Controller & Manufacturing Co., Cleveland, died recently.

CHARLES F. MACGILL, who was in charge of the bayonet department of the Remington Arms Co., and was works manager of the Bullard Machine Co., in Bridgeport during the war, died recently in Boston, aged 65 years. He began his engineering with the Calumet & Hecla Mining Co. and subsequently engaged in shipbuilding and still later in railroad engineering at Detroit and Duluth.

CAPTAIN HARRY GEORGE, U.S.N. (retired), who died at the Brooklyn Naval Hospital last week, was a member of the technical staff of the Chase Companies, Inc., of Waterbury, Conn. He was identified with the Chase organization since 1916. He was born in Cardiff, Wales, entered Annapolis at the age of 14 years, graduating as a three-star man and the youngest graduate of the naval academy.

JOHN HENRY HOBSON of the Hobson & Botts Co., manufacturer of metal specialties at Beaver Brook, Conn., died of apoplexy, recently, aged 65 years.

ROBERT C. COLTER, general auditor of the Zenite Metal Co. of Indianapolis, was killed recently in Asheville, N. C., when he was thrown from a horse while riding on a mountain trail. He was 48 years old and had been connected with the Zenite Metal Co. about five years.

PLINY SUMMERSKILL, a member of the firm, Summerskill Bros., Sowerby Bridge, Eng., died recently.

W. A. PEARN, aged 66 years, a member of the firm, F. Pearn & Co., Manchester, Eng., died recently.

ALBERT DARLING of the firm Darling and Sellers, Ltd., Keighley, Eng., died recently. Through error it was previously reported that Albert Sellers had died.

F. BROOK of the Gledhill-Brook Time Recorders, Ltd., Huddersfield, Eng., died recently, aged 64 years.

Pamphlets Received

Union Scale of Wages and Hours of Labor. United States Department of Labor. The Government Printing Office, Washington, D. C. The wages and hours of labor on May 15, 1923, in the various cities of the country and in the different trades are tabulated in this pamphlet. The booklet contains 196 pages and many tables of statistics.

Our World Trade. Foreign Commerce Deparment of the United States Chamber of Commerce. The period January-March of this year is covered in this pamphlet recently published. Value and volume of principal exports and imports between the United States and chief foreign markets are shown with comparisons with other years and periods.

Employment in Selected Industries. The United States Department of Labor. The Government Printing Office, Washington, D. C. Reports based on figures from 8,627 establishments in 52 industries are given. It shows that there was a decrease in employment and wages earned. The industries included employ 2,524,657 people who earned in one week in June $63,892,615.

Trade Catalogs

Soft Metal Hammers. The New England Sales & Engineering Co., 4 Walnut St., Worcester, Mass. The trade name for this product is "Notadent" and it is described in a six-page folder with illustrations and price lists. Its uses in machine shops and garages are explained.

Milling Cutters. The Ingersoll Milling Machine Co., Rockford, Ill. Certain types and sizes of milling cutters that are made by this company have been standardized and complete descriptions and illustrations of each type, both of the inserted tooth and solid varieties, are included in the catalog. A number of special cutters are also described and illustrated and notes are included with all descriptions suggesting the jobs that each type of cutter is best adapted for.

Electric Blowers. The Buffalo Forge Co., Buffalo, N. Y. A bulletin showing a new electric blower for forge fires, small furnaces, organs, or any work requiring intermittent service has recently been issued. The product is made with variable speeds and has a new enclosed regulator.

Drills. The Cleveland Twist Drill Co., Cleveland, Ohio. A poster has been sent to dealers for display. It is attractively designed in blue and various shades of orange and yellow and depicts a sphinx and pyramid scene.

Centers. The Eclipse Co., Detroit, Mich. This folder shows the Eclipse interchangeable center which has been built along the same principle of the Eclipse interchangeable counterbore. The economy of using these adjustable and interchangeable centers is stressed. Price lists and illustrations of the tool are also contained in the folder.

Electric Hammer Drill. The Chicago Pneumatic Tool Co., New York City. The product herein described is trade named "Little Giant Electric Hammer Drill" and, according to a notice on the folder, it is protected by patents in the United States and foreign countries, being licensed under the Burke Universal Motor patent. An illustration of the tool, a section drawing and pictures of parts of the drill are included in the folder which is perforated for filing.

Metal Bearings. The Magnolia Metal Co., 113-115 Bank St., New York City. The selection, working and care of the contact metal in lined bearings, are covered in this interesting booklet. Bearing metal made by this company is described in detail.

Chucks. The Cushman Chuck Co., Hartford, Conn. Catalog No. 42 with descriptions and illustrations of Cushman chucks, dimensions, specifications, prices and other data has been mailed out by this company. Sectional drawings show the details of the products.

Lubricating Devices and Oil Cups. The Gits Bros. Manufacturing Co., 1940 C. Kilbourn Ave., Chicago, Ill. Catalog No. 20 shows oil cups, oil covers, steel oil gages and other products of the company. Illustrations show their appearance and specifications show their uses. Each classification is described and the virtues set forth in an interesting manner.

Metal Cutting Machinery. The Racine Tool & Machine Co., Racine, Wis. The company has gotten out a chart for manufacturers on various requirements for cutting certain metals. Recommendaions are given as to the proper machine to be used. The chart is complete and of value to every manufacturer.

Loading Machinery. The Lakewood Engineering Co., Cleveland, Ohio. Loading machines and how they are used is shown in this little booklet which is entitled "Snap Shots of Sensible Savings." The many ways in which this company's products can be used are shown by small photos with short descriptions on the opposite page. The booklet is interesting and emphasizes the merits of the machines.

Manganese Steel Castings. The American Manganese Steel Co., Chicago Heights, Ill. Catalog No. 9 contains a large amount of information and data concerning the general subjects of the manufacture and the uses of manganese steel and, specifically, the various types of castings and equipment manufactured by the company. The catalog is well illustrated with photographs of various plant departments, products and views showing the products in operation.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Engineering supplies. Bologna, Italy. Agency. Reference No. 11,116.

Diesel and Semi-Diesel 60 to 300 hp. engines. Malaga, Spain. Agency. Reference No. 11,110.

Machines for manufacturing chains, horseshoe nails and tacks. Belgrade, Yugoslavia. Purchase. Reference No. 11,109.

Machine tools and mechanical novelties. Athens, Greece. Agency. Reference No. 11,111.

Scales or weighing machine for foundry. Belfast, Ireland. Purchase. Reference No. 11,119.

Forthcoming Meetings

New Haven Branch of the American Society of Mechanical Engineers. Fourth annual machine tool exhibit, Sept. 15-18. Mason Laboratory, New Haven, Conn. H. R. Westcott, chairman.

American Society for Steel Treating. Sixth Convention, Boston, Mass., Sept. 22, 23, 24, 25 and 26. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Motor and Accessory Manufacturers' Association. Annual meeting, Cleveland, Ohio, Week of Oct. 6.

American Foundrymen's Association. Twenty-eighth annual convention. Milwaukee, Wis. Week of Oct. 13, 1924.

National Industrial Advertisers Association. Annual meeting, Edgewater Beach Hotel, Chicago, beginning Oct. 13, 1924.

Management Week. Under the auspices of the American Society of Mechanical Engineers. Week of Oct. 20, 1924. New York City.

American Gear Manufacturers Association. Semi-annual fall meeting. Briarcliff Lodge, Briarcliff Manor, N. Y., Oct. 16, 17 and 18. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

American Society of Mechanical Engineers. Forty-fifth annual meeting. New York City. Dec. 1 to 4. Calvin Rice, secretary, 29 West 39th St., New York City.

National Exposition of Power and Mechanical Engineering. Grand Central Palace, New York City, Dec. 1 to 4. Charles F. Roth, 1102 Grand Central Palace Building, New York City.

Exposition of Invention. Engineering Societies Building, 29 West 39th St., New York City. Dec. 8 to 13 inc., General offices, 47 West 34th St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Pig-iron buying continues to call for small tonnage lots. Birmingham quotes the price on No. 2 foundry iron at $18@$18.50 per ton. The Pittsburgh market has not changed and the quotations on bars remains at $2.15 per 100 lb., with shapes and plates at $2 per ton.

Non-Ferrous Metals—The advance in the non-ferrous metal market continues into this week. Copper advanced ⅛c. since July 25; tin, ⅜c.; lead ¼c. per lb. New York. Antimony is now quoted at 10c. per lb.

(All prices as of Aug. 1)

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	18.00@18.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh	New York	Cleveland	Chicago
No. 10	$2.70@2.80	3.89	3.55	3.80
No. 12	2.85@2.90	3.94	3.60	3.95
No. 14	2.95@3.00	3.99	3.65	4.00
No. 16	3.15@3.20	4.09	3.75	4.10
Black				
Nos. 17 and 21	3.50	4.40	4.25	4.55
Nos. 22 and 24	3.55	4.45	4.30	4.55
Nos. 25 and 26	3.60	4.50	4.35	4.60
No. 28	3.50@3.65	4.60	4.45	4.50
Galvanized				
Nos. 10 and 11	3.60@3.80	4.65	....	4.60
Nos. 12 and 14	3.70@4.90	4.75	....	4.70
Nos. 17 and 21	4.00@4.20	5.05	....	5.00
Nos. 22 and 24	4.15@4.35	5.20	5.00	5.15
No. 26	4.30@4.50	5.30	5.25	5.30
No. 28	4.60@4.80	5.60	5.55	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	56%	43%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	53%	40%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 36% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ⅛-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
⅛	$0.09	50%	⅞	$0.16	35%
¼	.11	45%	1	.18	31%
⅜	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	7.50	8.00	6.55
Hoop steel	4.49	3.96@4.36	4.15
Cold rolled strip steel	7.00	8.25	7.15
Floor plates	5.55	4.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.21	3.10
Soft steel bars (base)	3.24	3.11	3.00
Soft steel bar shapes (base)	3.24	3.21	3.00
Soft steel bands (base)	3.99	3.61	3.65
Tank plates (base)	3.34	3.43½	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Tool steel	11.00	....	....
Drill rod (from list)	60%	40@55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13.625
Tin, 5-ton lots, New York			50.25
Lead (up to carlots), St. Louis	6.95	New York	8.00
Zinc (up to carlots), St. Louis	6.05	New York	6.75

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	27.10	28.00	28.50
Antimony (Chinese), ton spot	10.00	10.50	10.00
Copper sheets, base	19.50	19.75	22.50
Copper wire, base	15.00	17.50	21.25
Copper bars, base	18.75	20.75	22.00
Copper tubing, base	21.75	25.75	24.75
Brass sheets, base	16.25	20.50	19.25
Brass tubing, base	20.50	25.50	27.25
Brass rods, base	14.00	16.50	17.00
Brass wire, base	16.75	20.50	19.75
Zinc sheets (casks)	10.25	10.75	....
Solder (½ and ½), (case lots)	36.50	32.00	30.00
Babbitt metal (83% tin)	60.00	58.50	48@52
Babbitt metal (35% tin)	28.00	17.50	23@26
Nickel (ingot and shot) f.o.b. refinery	27.00	....	....
Nickel (electrolytic) f.o.b. refinery	30.00	....	35.00
Nickel (F shot) f.o.b. refinery	30.00	....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Rolled nickel sheet (base)	52.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Shop Materials and Supplies

METALS—Continued

Manganese nickel hot rolled rods "E"—low manganese (base) 54.00
Manganese nickel hot rolled rods "D"—high manganese (base) 57.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00@10.75	10.00	9.50@10.00
Copper, heavy, and wire	9.62½@10.50	9.75	9.50@10.00
Copper, light, and bottoms	8.50@9.00	8.25	8.00@8.25
Lead, heavy	5.62½@6.00	5.00	5.00@5.50
Lead, tea	4.37½@5.00	3.00	3.00@3.25
Brass, heavy, yellow	6.50	8.50	6.00
Brass, heavy, red	8.50@8.75	5.00	7.50
Brass, light	5.75	5.50	5.00
No. 1 yellow brass turnings	6.50@6.75	3.50	6.00
Zinc	3.50@3.75	.....	2.50

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$23.50	$22.85	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	19.00	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	13.00	13.00	14.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.75	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.14@0.21	$0.20	$0.14
Cotton waste, colored, per lb.	.09@.14½	.17	.10½
Wiping cloths, 13½x13½, per lb	11.25*	36.00 per M	.16
Wiping cloths, 13½x20½, per lb.	...	52.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	1.05	1.09	1.05
Lard cutting oil, 25% lard, per gal.	.55	.50	.79†
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.214
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber transmission:			
First grade	50%	50–10%	40–10%
Second grade	50–10%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	$6.48
Emery paper	10.71	11.00	8.80
Emery cloth	28.00	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag	...	.65	.60
Coke, prompt furnace, Connellsville	per net ton		3.00@3.25
Coke, prompt foundry, Connellsville	per net ton		4.25@4.75
White lead, dry or in oil	100 lb. kegs		New York, 14.50
Red lead, dry	100 lb. kegs		New York, 14.50
Red lead, in oil	100 lb. kegs		New York, 16.00

*White, at washery.
†Chicago quotes on pure lard oil, No. 1 grade.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0334	$0.0349	$0.0354
Cold finished shafting	per lb.	0.0425	0.044	0.044
Brass rods	per lb	0.14	0.145	0.18
Solder (½ and ½)	per lb.	0.3375	0.335	0.285
Cotton waste	per lb.	.14@.21	.14@.21	.10@.13
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	0.55	0.55	0.55
Machine oil	per gal.	0.29	0.29	0.297
Belting, leather, medium	off list	40–2½%	40–2½%	30–10%
Machine bolts up to 1x30 in.	off list	50%	50%	30%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	50%	60–10–5%	60%
1½ and 1½x3 in. up to 12 in	15%	60%	60%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	40%	$3.50 net	60%
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	45%	3.50 net	60%
Button head bolts, with hex. nuts	10%	List net	.....
Hex. head and hex. nut bolts	10%	.....	.....
Lag screws, coach screws	50%	.....	65%
Square and hex. head cap screws	75%	75%	.....
Carriage bolts, up to 1 in. x30 in.	40%	60%	55%
Bolt ends, with hot pressed nuts	50%	.....	60%
Tap bolts, hex. head, list plus	35%	.....	$4.65
Semi-finished nuts, $\frac{7}{16}$ and smaller	70%	.....	.....
Semi-finished nuts, ½ and larger	65%	70%	.....
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$3.75
Washers, cast iron, ⅝ in., per 100 lb. (net)	5.50	4.00	3.75
Washers, round plate, per 100 lb. Off list	1.90	4.50	4.50
Nuts, hot pressed, sq., per 100 lb. Off list	1.50	4.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.50	4.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.50	4.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.50	4.00	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	50%	60–10%	70%
Rivets, tinned	50%	60–10%	70%
Button heads ½-in., ¾-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.50	$3.50
Cone heads, ditto (net)	5.20	3.60	3.70
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅜ in. diameter *EXTRA*	0.35	.....	0.15
½ in. diameter *EXTRA*	0.75	.....	0.50
1 in. long, and shorter *EXTRA*	0.75	.....	0.50
Longer than 5 in. *EXTRA*	0.50	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.45	.....	$4.20 base

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Calif., Hanford — Hanford Joint Union High School Dist., G. H. Rogers, Clk.—
One No. 27-A South Bend standard change and one No. 69 quick change gear lathe.
One semi-machined chuck back to fit 10 in. independent lathe chuck.
One No. 34, 6 in. Cushman Universal chuck with inside and outside jaws.
One 4 in. 3 jaw Universal chuck with style 34 with both inside and outside jaws.
One Cushman 10 in. Independent lathe chuck with 4 jaws reversible, lathe tool holders.
One No. 8, one No. 10 Armstrong boring bars, one No. 30-R and one No. 32-R Armstrong cut off bars.
One No. 5 South Bend milling keyway cutting attachment.
One No. 1 plain milling cutter.
Safety headless drop forge lathe dogs, sizes 1, 2, 3, 4, 5 and 6.
One No. 2 Little Giant drill chuck complete with No. 3 Morse taper arbor.
One No. 6 W. drill set complete.
One Curtis No. V-1-A alternate No. V-2-A air compressor unit, or one V-20 Curtis motor driven air unit, welding outfit. One No. 62 Smith oxyacetylene welding outfit.
One No. 802 tool Flexible shaft and attachment complete.
Blacksmith equipment.
Taper Shank drills.
One No. 1½ Smith & Mills plain crank 14 in. shaper.

Conn., New Haven—Pierce, Carroll & Co., 177 Church St.,—heavy duty engine lathe, 16 in. swing, 10 ft. bed, quick change gear complete with countershaft, production drill, 16 in. spindle to column minimum, 14 in. crank geared shaper, power saw, sensitive drill, double arbor emery wheel.

D. C., Wash.—A. L. Flint, Genl. Purch. Office of Panama Canal is receiving bids until Aug. 18—metal cutting machine.

D. C., Wash.—A. L. Flint, Genl. Purch. Officer of Panama Canal, is receiving bids until Aug. 7 —combination chuck.

Ky., Louisville—U. S. Engineer's Office, P. O. Box 72,—one torch, cutting and welding, oxy-acetelyne, 6,500 lb. steam pile hammer for Dam 52, band saw 32 in. belt driven with tilting table 28 x 24 in.

N. Y., Brooklyn—G. Creamer, Foot of Bay 32nd St.—electric twin drum.

O., Cincinnati—Doermann-Roehrer Co., 318 East 3rd St.—plate grinder for surfacing cast iron brick die plates with travel 36 x 12 in. width.

O., Cleveland—Atlas Car & Mfg. Co., Ivanhoe Rd.—open side planer.

O., Cleveland—Stahl Gear & Machine Co., 1390 East 40th St.—one 36 in. spiral and spur gear shaper.

W. Va., Logan—Guyan Machine Shop—hydraulic wheel press 250 ton capacity or larger, motor driven. Noted Feb. 21.

Wis., Milwaukee—Automotive Parts Mfg. Co., c/o O. L. O'Boyle, Majestic Bldg.—drill presses, lathe, grinder and bench tools.

Wis., Milwaukee—Central Bd. Purchases, City Hall,—one 16 in. and one 30 in. lathe.

Wis., Milwaukee—W. Ortman, P. O. Box 673 (machinist)—medium size lathe, one lathe for tool room, 20 and 22 in. drill presses.

Wis., Milwaukee—Reo Mfg. Co., 809 Winnebago St.—M. Hollisch, purch. agt.—machinery and tools for manufacture of brass goods for plumbing supplies.

Wis., Milwaukee—P. Weinstein, 732 6th St.—traveling crane.

Wis., Plymouth—H. W. Motor Sales Co., C. Helming, Purch. Agt.—lathe for garage and machine shop, emery grinder.

N. B., Ripples—Coburn Lumber Co. Ltd., E. Coburn, Purch. Agt.—complete equipment for saw mill.

Ont., Milverton—H. & E. Furniture Co.—woodworking equipment, electric power planers, saws, etc.

Ont., Toronto—Conboy Carriage Co. Ltd., Don Roadway—woodworking and sheet metal working equipment, electric power.

What This Section Is

Machinery Requirements and Industrial Construction is a reliable machinery market, because every item is reported first-hand by our own correspondents, scattered over the United States and Canada. These leads are verified by our men. We do not use newspaper clippings, nor do we listen to any hearsay or rumors. These sales leads are as accurate as our men can make them, and as timely as weekly publication will permit.

This market is for *American Machinist* subscribers. It covers the same machinery fields as does the paper. Here will be found inquiries for machine tools, presses, hammers, welding, forging and heat treating equipment, wood working machinery, cranes, hoists and other material handling machinery for the shop.

Here also will be found reports of proposed industrial construction, where sooner or later machinery will be needed.

Are you making the most of the opportunities listed here?

Que., St. Hyacinthe — G. Lessard, 139 William St.—equipment for blacksmith shop for general work.

Que., St. Scholastique—L. P. Savage—lathe, drill and grinder.

Que., Ste. Therese—Charron & Freres,—additional equipment for sash and door manufacture.

Que., Ste. Therese—E. Roy—machinery and equipment for garage.

Que., Macaza—J. Brunneau—equipment and machinery for saw mill.

Que., Montreal—Rochon & St. Joes, 190 Murray St.,—complete equipment for automobile repair shop.

Que., Montreal—F. Tremblay, 2072 Jeanne Mance (Saw Mill)—complete equipment and machinery to replace loss by fire.

Que., Montreal — Qust Motors Ltd., 5 Park Ave.—complete equipment for automobile repair shop at 813 St. James St.

Que., Quebec City — E. Andrews, 281 Arago St. (garage, etc.)—lathe and drill.

Que., St. Jerome—W. Fillion, 55 St. Jean Baptiste St., (saw mill)—and saws, planer, etc.

Opportunities for Future Business

Calif., Emeryville—Pacific Gas & Electric Co., 445 Sutter St., San Francisco, awarded contract for the construction of shops, storage yards, foundry and electrical shops, etc., here. $500,000. Noted July 17.

Conn., Bantam — Trumbull-Vanderpoel Electric Mfg. Co. has awarded the contract for the construction of a 2 story and basement, addition to present plant. $40,000. Private plans.

Conn., Hampden — United Smelting & Aluminum Co. plans to rebuild plant recently destroyed by fire. $100,000. Engineer and architect not selected.

Conn., Stratford — Bridgeport Safety Emery Wheel Co. awarded contract for construction of a 1 story, 90 x 240 ft. factory. To exceed $40,000.

Ill., Chicago — The Birtmann Electric Co., 640 West Lake St., will soon award the contract for the construction of a 3 story, 167 x 311 ft. factory for manufacture of vacuum cleaners and electric appliances on Fullerton Ave. Estimated cost $350,000. E. H. Tromann, 64 West Randolph St., Archt.

Ind., Evansville—W. F. Hortig Plow Co. awarded the contract for the construction 2 story, foundry, Morgan St. $60,000.

Ind., Laporte—Indiana Pattern & Model Co. awarded the contract for the construction of an addition to plant. $40,000.

Kan., Kansas City—Fairfax Iron & Steel Co., Federal Reserve Bank Bldg., will build 1 story, 160 x 700 ft. factory, by day labor. Horner & Wyatt, 306 McMillan Bldg., Engrs. Noted Apr. 3.

Mass., Allston (Boston P. O.)—International Harvester Co. of America, 43 Somerville Ave., Somerville, plans to construct a 1 story, repair and service plant, at 63-71 North Beacon St., here. $50,000.

Mass., Somerville—Plant—Lombard & Co., 236 A St., South Boston, is receiving bids for construction of a 1 and 2 story, 50 x 150 ft., plant, Middlesex Ave. $40,000.

Mont., Miles City—State Bd. Examiners, A. E. McFatridge, Clk., Helena, awarded the contract for the construction of hospital, kitchen and industrial shop buildings at State Industrial School. Noted July 24.

O., Cleveland—Garage—The Cleveland Rathway Co., c/o G. L. Radcliffe, Genl. Mgr., Hanna Bldg., had preliminary plans prepared for the construction of a 2 or 3 story garage, Central Ave. near 89th St. $150,000. Watson Co., 4614 Prospect Ave., archts.

O., Kert—Fageol Motors Co. of California, plans to construct 50 x 200 ft. factory unit. $150,000.

Okla., Tonkawa — Ford Motor Co. is having plans prepared for the construction of a 1 story, 100 x 129 ft. plant. $40,000. Ellis Charles & Co., Orpheum Bldg., Wichita, Kans., Archts.

Ont., Toronto — Conboy Carriage Co. Ltd., Don Roadway, plans to rebuild 3 story and basement factory, recently destroyed by fire.